# A COMPREHENSIVE CRITIQUE OF THE AMERICAN COLLEGE HEALTH ASSOCIATION'S NATIONAL COLLEGE HEALTH ASSESSMENT SURVEY INSTRUMENT

A Dissertation

by

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DOCTOR OF PHILOSOPHY

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ABSTRACT

There are many instruments used to identify health behaviors of a population. Used by both practitioners and researchers, one such instrument is the American College Health Association's National College Health Assessment (ACHA NCHA). While there are numerous published articles indicating use of the instrument, questions arise in the mind of the researcher whether data collected by the ACHA NCHA I and the ACHA NCHA II was valid and reliable. Psychometric properties of the instrument used to collect data on health behaviors are crucial in order to ensure the data are good quality data. Therefore, the purpose of this study is to reexamine the ACHA NCHA II by assessing the validity and reliability of the instrument while simultaneously studying one selected health behavior: withdrawal as a contraceptive method among the U.S. college population.

This study is an exploration utilizing quantitative methodology to examine the validity and reliability of the data produced by the ACHA NCHA II and the effectiveness of the instrument in assessing college student health behaviors, trends, and perceptions. Two data sets, both used as secondary data and collected using the NCHA II, are used to assess the instrument: a data set collected at a single campus in three different semesters and a data set collected on multiple campuses in a single semester, combined to form a reference group. Data are analyzed to address psychometric properties by using Cronbach's alpha and Factor Analysis to identify whether data are valid and reliable.

The study findings reveal that the ACHA NCHA II is an instrument that should be used to collect frequency only data on college campuses. Use of the instrument to conduct higher level data analyses such as ANOVA and structural equation modeling should be done with caution as data produced by the ACHA NCHA II are mostly nominal or ordinal scale. Based on the findings from this study, it is suggested that an editing of the original instrument is needed, to allow researchers working on college campuses more opportunities to examine specific college health behaviors, habits, and trends. Finally, the instrument is implemented to study withdrawal as a contraceptive method in college students while simultaneously investigating the instrument's effectiveness. Use of withdrawal as a method for contraception, the third most common method used by college students, is predicted in the data from this study by being female, being of Black/non-Hispanic descent, having high numbers of sexual partners, and being in an emotionally abusive relationship. In conclusion, the researcher from this study suggests that the instrument requires significant improvements before future use for research studies, including a reexamination of its questions and segmenting the items into a few smaller, more manageable instruments.

# DEDICATION

This dissertation is dedicated to my best friend, confidant, pillar, editor, and husband, Clint. Without your constant support I would not be here. Thank you for never letting me quit, never giving up on me, and keeping me sane (I know it was hard) for the past five years. In the 17 wonderful years we have been together, you have supported and loved me through two rounds of graduate school. I could not have done this without you. I love you with all of my heart and it is truly a privilege and an honor to be your wife. You are an amazing man, husband, and father.

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To all the students I have taught, thank you for your kind thoughts and for being Aggies. You are the reason I went back to school when I was perfectly happy being a health educator.

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# CHAPTER I

## INTRODUCTION AND RATIONALE

Many self-report instruments are used to measure the health behaviors of individuals. One such instrument, used to measure the health behaviors of college students, is the American College Health Association's National College Health Assessment (ACHA NCHA). The ACHA NCHA is a questionnaire used on college campuses nationwide each fall and spring semester. It is a nationally recognized survey instrument that aids college health professionals in identifying health habits, behaviors, and perceptions of students on their campuses. The ACHA serves college health professionals further by collating the data from the ACHA NCHA from many campuses into large databases (i.e., reference group) for further secondary analysis (ACHA, 2013a).

The instrument was initially developed in 1999 by an interdisciplinary team of college health professionals at institutions of higher education. The ACHA NCHA consists of 300 questions assessing a variety of health behaviors practiced by, as well as habits and perceptions of, college students (American College Health Association [ACHA], 2013a). The ACHA NCHA consists of questions taken from a variety of adolescent health based questionnaires including the Harvard College Alcohol Study (Wechsler & Nelson, 2008) and the Centers for Disease Control and Prevention's College Health Risk Behavior Survey (Douglas et al., 1997). Items were selected by an interdisciplinary team of professionals working in college health by matching questions regarding specific health behaviors to behaviors known to exist among college student

populations. The ACHA NCHA aids researchers and health educators in collecting data on a wide array of health topics including alcohol, tobacco, and other drug use; sexual health; weight, nutrition, and exercise; mental health; and personal safety and violence (ACHA, 2013a).

In 2008, the American College Health Association revised the tool, resulting in the ACHA NCHA II. The revision involved rewording some questions, adding questions to reflect newly identified behavior changes among the college-aged population (for example, the NCHA II contains questions on hookah use and college students), and deleting questions that appeared to be irrelevant to current college-aged students (for example, a question regarding credit card usage was deleted from the questionnaire). The ACHA NCHA II was intended, first, to be a revised instrument but with the extensiveness of the revisions, additions, and deletions, more than just a revision resulted.

## Purpose

The completed work of this dissertation is expected to fill a knowledge gap about the use of the American College Health Association National College Health Assessment II (ACHA NCHA II). This was an exploratory study utilizing quantitative methodology to examine the validity and reliability of the data produced by the ACHA NCHA II and the effectiveness of the instrument in assessing college student health behaviors, trends, and perceptions. Results may have a positive impact by providing knowledge to college health professionals regarding not only use of a popular survey

instrument on college campuses but also an understanding of a single health behavior among college students: withdrawal as a contraceptive method.

The research question that guided this project was, "Is the ACHA NCHA II an effective and appropriate research and survey instrument in the study of college students' health behaviors?" While initial evidence indicates wide use of the instrument, to date there was no systematic investigation regarding the actual extent of usage, the situations/context for which it was used, and the characteristics of the data derived from its administration. To further test the instrument's utility for gauging college students' behaviors, the researcher proposed to examine a select behavior targeted by the questionnaire. Because, to the researcher's knowledge, there are no published studies examining the behavior of withdrawal as a contraception method among college students, the researcher believed an investigation using secondary findings from the instrument might help illustrate and examine the strengths and weaknesses of the ACHA NCHA II.

The goal of this project was to assess the data produced by the NCHA II and its usefulness as a tool for health surveillance and research involving American college students. The central hypothesis was that the ACHA NCHA II produces valid and reliable data that college health professionals can trust when making decisions regarding policies and programs related to college student health behaviors and issues. Professionals in the field of health education expect these data to be of high quality in order to develop programs and interventions for college students. In order to achieve this goal, three specific aims were proposed. The first aim, a systematic literature review

of published manuscripts utilizing data derived from implementation of the ACHA NCHA I or ACHA NCHA II, assessed how the ACHA NCHA I and II have been used by college health professionals and researchers. Specific attention was paid to the administration of the instrument, the use and analyses of the resulting data, reported psychometric properties, and reported limitations of the NCHA I and II by the researchers. The second aim was to assess the psychometric properties of the ACHA NCHA II by conducting validity and reliability tests. This aim led to recommendations regarding the quality and use of the ACHA NCHA II in future assessments of college student health behavior. The third aim consisted of testing the utility of the ACHA NCHA II by examining one selected behavior, withdrawal as a contraceptive method, among college students. The researcher wanted to identify whether the ACHA NCHA II examined what it was intended to examine. Close attention was paid to the strengths and weaknesses of the instrument, the validity of the data, and its value regarding policy and programming decisions by college health professionals.

The approach proposed was innovative because researchers examined an instrument used nationwide on many college campuses – an instrument that was 'taken for granted' as representative of college student health habits, behaviors, and perceptions. This project stands to have a positive impact by providing college health professionals in health promotion with an assessment of a widely used instrument and a recommendation for its continued, modified, or discontinued use. The proposed research is significant because it involves a multidimensional approach to the examination of the ACHA NCHA II. It involves a study of the survey instrument's

appearance in the literature, a study of the instrument itself, and a study of one selected behavior, using data derived from the practical implementation of the instrument.

This contribution is significant because this is the first study (other than the original testing for reliability and validity conducted by ACHA) to examine the quality of the data and usefulness of the instrument in assessing college student health behaviors. With so many colleges and universities administering it, is the ACHA NCHA II truly an adequate method for health behavior data collection on college campuses? Given the number of colleges and universities utilizing the tool, it is important to obtain an informed answer to this question.

## Statement of the Problem

For the past 15 years, the American College Health Association National College Health Assessment (ACHA NCHA) I (until 2008) or II (since 2008) have been implemented on college campuses nationwide. To the best of the researcher's knowledge, however, and since the original implementation in the spring of 2000, there have been no published studies conducted to examine whether this instrument was effective in collecting the data it was expected and intended to collect. The impact from this innovative research will be expanded knowledge of the ACHA NCHA II as an instrument for data collection regarding college student health behaviors as well as expanded knowledge regarding why college students choose withdrawal as a method of contraception.

## Research Questions

The over-arching research question was: "Is the ACHA NCHA II an effective and appropriate research and surveillance instrument in the study of college students' health behaviors?" The current study addressed this via three individual, yet related, studies which included a comprehensive review of the literature, an investigation of the psychometric properties of the instrument, and the investigation of a common health behavior in college students using the instrument. Each study was conducted to stand alone.

This dissertation is comprised of five chapters. In Chapter I (current chapter), an overview of the entire study and brief introduction and rationale is provided. Each of Chapters II, III, and IV is in the form of independent manuscripts described below. The research questions guiding Study 1 are: "(1) How was the instrument administered in the studies? (2) What data analysis techniques were used? (3) Were psychometric properties addressed and/or measured and if so, how? and (4) What were the limitations of the instrument as listed in the published studies?" Study 1 is a comprehensive literature review designed to address use of the ACHA NCHA I and II in empirical studies of college student health behaviors.

The research question guiding Study 2 is: "Does the ACHA NCHA II exhibit adequate psychometric properties to be used as both a surveillance and research tool?" The chapter is an investigation of instrument-related factors (theoretical base, level of specificity, intended use), factors impacting the quality of the data (validity and

reliability), and actors beyond the actual instrument (how questions are asked, words used, layout).

The research questions guiding Study 3 are: "(1) What behavioral and demographic characteristics are associated with withdrawal as a contraceptive method among college students and (2) Is the NCHA II an adequate tool to address this and other health behaviors in this population?" The researcher examined the NCHA II while simultaneously investigating withdrawal as a contraceptive used by college students.

Chapter V is comprised of the conclusion, limitations, discussion, implications for practice and future directions of the overarching study. Also in Chapter V, the researcher issues a challenge to the ACHA to improve upon the NCHA II for use in the college population.

# CHAPTER II

# A SYSTEMATIC REVIEW OF THE RESEARCH LITERATURE IN WHICH THE AMERICAN COLLEGE HEALTH ASSOCIATION NATIONAL COLLEGE HEALTH ASSESSMENT I OR II ARE UTILIZED

## Introduction

Many instruments are available to researchers for identifying health behaviors of a population. One such instrument, used to assess health behaviors among college students, is the American College Health Association's National College Health Assessment (ACHA NCHA). The ACHA NCHA is a questionnaire implemented on college campuses nationwide each fall and spring semester and is a nationally recognized health assessment tool initially developed in 1999 by an interdisciplinary team of college health professionals. It was created for use by health professionals and researchers working at institutions of higher education. The instrument was developed to cover seven content areas for health behaviors typically found among college students: (1) health, health education, and safety; (2) alcohol, tobacco, and drugs; (3) sex behavior, perceptions and contraception; (4) weight, nutrition and exercise; (5) mental and physical health; (6) impediments to academic performance; and (7) demographics. These seven areas of content comprise over 300 questions (American College Health Association [ACHA], 2004). Data resulting from instrument administration reflect students' health habits, behaviors, and perceptions (ACHA, 2013a). The ACHA NCHA consists of questions taken from a variety of adolescent health based questionnaires including the Centers for Disease Control and Prevention's Youth Risk Behavior

Surveillance. Items were selected by the professionals working on college campuses by matching questions regarding specific health behaviors to behaviors known to exist among college student populations (ACHA, 2004).

College health professionals and researchers have implemented the American College Health Association National College Health Assessment (ACHA NCHA) with their student populations on campuses since 2000. Between 2000 and 2008, 832 institutions of higher education and 555,192 students participated in the NCHA I. Since the fall of 2008, 737 IHEs and 534,661 students participated in the NCHA II (American College Health Association [ACHA], 2013c). Since the spring of 2000, 624 unique institutions have participated while 173 institutions participated four or more times, 268 three or more times, and 408 two or more times, thus indicating the popularity of this instrument (ACHA, 2013c). The ACHA indicates advantages to using this instrument as (1) having a broad reach to cover a wide range of health issues in college students; (2) being flexible so institutions can add their own questions to the instrument; (3) not being a burden on students as it is simple and easy to complete, and finally; (4) being a good value for the budget (ACHA, 2013a).

In 2008, the American College Health Association revised the tool, resulting in the ACHA NCHA II. The revision involved rewording some questions, adding questions to reflect newly identified and emerging behaviors among the college-aged population, and deleting questions that appeared to college health professionals to be irrelevant to current college-aged students. These suggestions were based on results from the NCHA I from the periods it was implemented between 2000 and 2008 (ACHA,

2008b). The ACHA NCHA II was intended, first, to be a revised instrument, but with the extensiveness of the revisions, additions, and deletions, more than just a revised instrument resulted (ACHA, 2008b). An example of the changes from I to II is that several types of questions with a "select all that apply" structure were eliminated from the NCHA II. These types of questions were judged to be inherently psychometrically weak (ACHA, 2008b).

Currently, the NCHA II is used by college health professionals and researchers to identify common health beliefs, behaviors, and perceptions of students on their campuses. Researchers and health professionals use the instrument in an effort to understand health and behavior risks affecting students' academic performance; design health promotion programs on campus with evidence to support a design; create social norms marketing campaigns; appropriately and efficiently allocate monetary and staffing needs for campus health education programming; provide needs assessment data for campus task forces; have data available for policy discussions and presentations; open a dialogue about health behaviors of students; develop proposals to secure grant funding; and evaluate health promotion programs by conducting repeat administrations (ACHA, 2013b). Institutions of higher education self-select to implement the NCHA on their campus. Principle investigators at these institutions can request two types of use for the instrument: (1) to implement the assessment on a campus as a primary research investigation or (2) to utilize the reference group data set as a secondary research investigation.

## Purpose

The purpose of this systematic literature review was to critically analyze the literature in which researchers have utilized the NCHA I or the NCHA II. The following questions guided the review: (1) How was the instrument administered in the studies? (2) What data analysis techniques were used? (3) Were psychometric properties addressed and/or measured and if so, how? and (4) What were the limitations of the instrument as listed by the researchers in the published studies? The researcher of this review sought to address the issue of whether this instrument has been used appropriately and whether the data have been appropriately analyzed as published in the literature. To the researcher's knowledge, a review with this focus has not been conducted.

## Methodology

A systematic literature review was the chosen methodology for this study. This type of review is beneficial over other types of literature reviews because the researcher felt it was important to assess use of the NCHA, both I and II, in the literature. Further, systematic reviews can establish whether research findings are consistent (Mulrow, 1994), and for this review, can determine a set of common limitations as experienced by researchers and practitioners using the NCHA I or II to answer their research questions. Further, as this study is an investigation of psychometric properties addressed by users of the NCHA I and II, systematic reviews can help establish the reliability and accuracy of conclusions (Mulrow, 1994). The review process involved a rigorous search to generate a comprehensive list of published research reports utilizing the American College Health Association National College Health Assessment (ACHA NCHA) I and

II. Major steps included (a) database search to identify relevant articles, (b) development of inclusion/exclusion criteria to select articles, (c) screening process to identify psychometric properties investigated, data analyses used, and limitations of the NCHA, (d) instrument development for guiding the extraction of information from selected articles, and (e) data extraction to retrieve characteristics from each selected article.

## Database Search

A systematic approach was used to retrieve peer-reviewed articles utilizing the ACHA NCHA I or II. A medical librarian with training and expertise in the health education and public health literature was consulted to determine appropriate databases. A single search term was used: National College Health Assessment. Four major databases, Medline (Ovid), EMBASE, CINAHL, and ERIC, were utilized for the initial search. Google Scholar™ was used after the initial search was completed and resulted in 14 additional articles. The date of the last search was July 2013. All retrieved articles were saved into *RefWorks* – an online reference management software program. The initial database search resulted in 202 published research reports.

## Inclusion/Exclusion Criteria

An article was included for further screening if the study (a) was written in English, (b) was published as a peer-reviewed journal article, (c) reported results conducted with a population of college students, and (d) presented a primary or secondary analysis of data collected using the NCHA I or II. Exclusion criteria included (a) articles that could not be evaluated because they were written as simply a

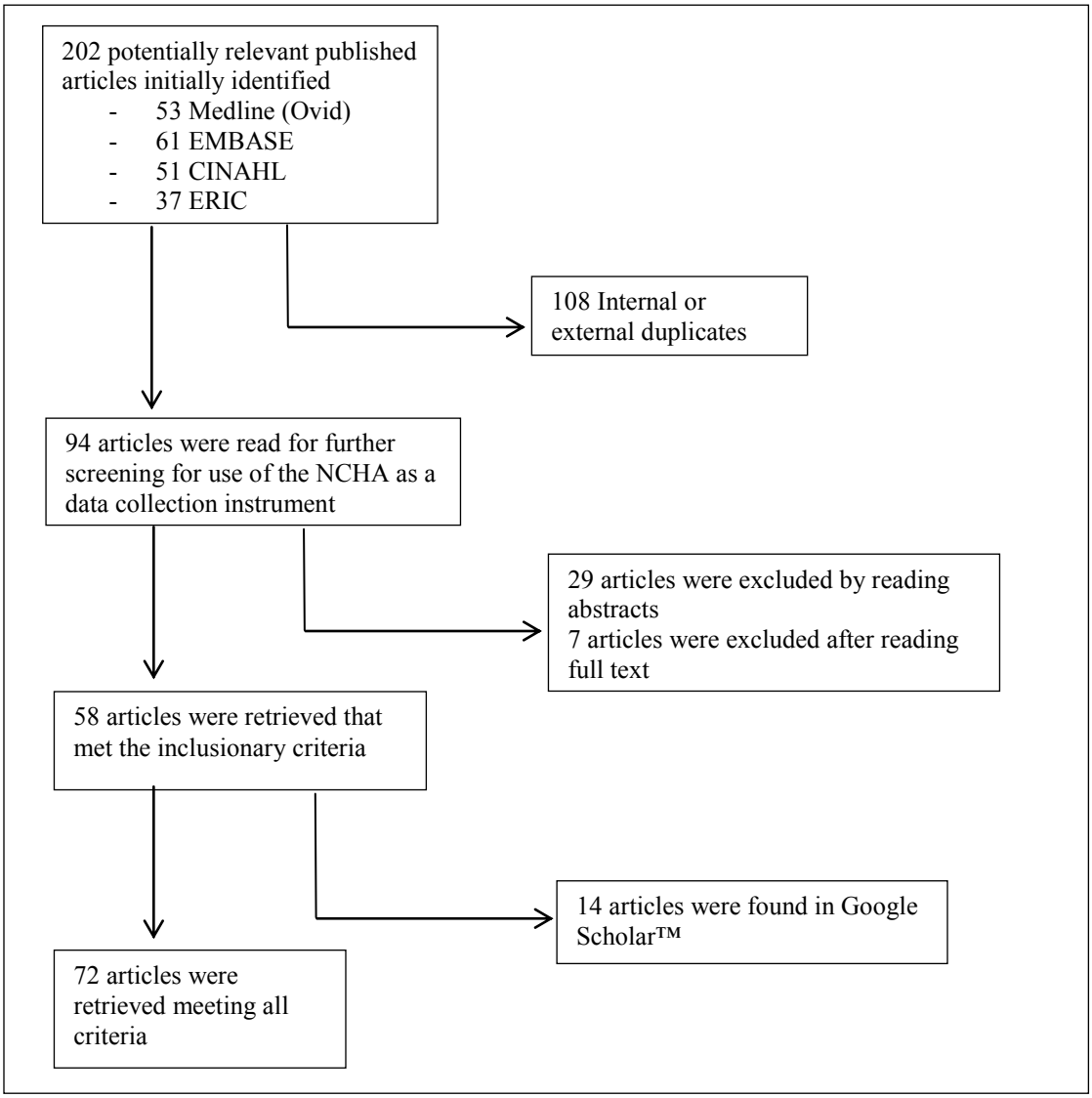
review of frequency data and not as empirical research studies, dissertations/theses (the researcher was solely interested in studies that have been through the external peer-review process), non-peer reviewed studies, or conducted only with graduate/professional student populations. Studies of graduate and professional student populations are not representative of college undergraduate students between the ages of 18 and 24 (Simons, Gaher, Wray, & Reed, 2012).

## Screening of Articles

The screening process involved two tiers. First, screening questions based on the inclusion/exclusion criteria were generated. After implementing the screening questions, 94 out of 202 useable abstracts were included for further review. Abstracts were then read by the researcher to determine whether the studies warranted further review and were placed into "yes", "no", and "maybe" categories. Second, full articles in the "yes" and "maybe" categories were read by the researcher and evaluated. Duplicates, literature reviews, frequency data report publications only, and dissertations/theses (again, the researcher for this review was solely interested, for this review, in external peer-reviewed articles. Future studies should include dissertations/theses as well as conference presentations) were automatically excluded. Studies utilizing the NCHA I or II to collect both primary data and use of the reference group (the reference group is a collection of data set from the implementation of the NCHA I or II on individual campuses each semester) secondary data were kept in the pool, resulting in a final number of 72 articles for inclusion in the review. The process for article screening is displayed in Figure 2.1.

Figure 2.1.

Results of Selection Process of Retrieved Articles




## Instrumentation

A coding spreadsheet was generated using Microsoft Excel® to capture the characteristics identified among the reviewed articles. This spreadsheet was used to guide identification and assessment of characteristics among reviewed articles such as

the purpose of the study, psychometric properties addressed, study design, type of data analysis utilized, theoretical framework, and limitations of the study.

## Data Extraction

Characteristics of studies (i.e. purpose, psychometric properties addressed, study design, data analysis techniques, theoretical framework, and limitations) were entered into the coding spreadsheet, and then compared across articles by identifying commonalities in the studies.

## Results

Among the 202 articles initially identified, 72 met the criteria for inclusion in the review. Fifty-four (75%) of the studies conducted utilized the NCHA I while 18 (25%) utilized the NCHA II.

*How was the instrument administered in the studies? (Question #1)*

Most of the researchers used the instrument in one of two ways: (1) to conduct a primary investigation of students on their campus or (2) to utilize the reference group data set for a secondary analysis of student behavior collected on campuses across the nation during a specific fall or spring semester. In twenty-seven (37.5%) of the 72 articles, researchers obtained data through primary data collection on their campuses while 45 (62.5%) of the studies utilized reference group data for secondary analysis. As an example of primary data collection, Gillman, Kim, Alder, and Durrant (2006) implemented the NCHA I on their campus at the University of Utah. The researchers sent the web-based questionnaire to randomly selected students and offered movie tickets and a gift certificate to the campus bookstore as incentives. The resulting sample

size was 1,059 University of Utah students. For another study, Primack, Land, Fan, Kim, and Rosen (2013a) utilized the reference group data collected by the ACHA and included all institutions implementing the NCHA II during the 2008-2009 academic year. The resulting sample size was 100,891 students. Researchers using the reference group indicated that data were collected through both paper- and web-based methods and a variety of different incentives were used to encourage participation. Each campus represented in the reference group collected data utilizing one of these methods.

*What data analysis tests were used? (Question #2)*

Researchers used different data analyses and several had to transform the data in order to be able to utilize specific statistical tests, techniques, or methods. Although there was nothing inherently wrong with the transformation of the data, using transformed data may have led to the misinterpretation of some results, such as difficulty in interpreting confidence intervals (Bland & Altman, 1996). Further, using inappropriate data analyses on data sets may invite an abuse of statistics (Duncan, 1984). There were 32 different types of analyses, post-hoc and other tests run on the data. The most common techniques included chi-square; logistic/linear regression; confidence intervals; independent t-tests; and ANOVA. The studies in which these five most common data analyses techniques are used for the NCHA I or II are listed in Table 2.1.

Table 2.1

Most Commonly Used Data Analysis Techniques, Procedures, and Tools on Data Gathered from the NCHA I or II

| Chi-Square | Logistic/linear regression (multivariate, univariate, &/or bivariate) | Odds ratios / Confidence intervals | Independent t-tests | ANOVA |
|---|---|---|---|---|
| Adams & Araas (2006) | Adams & Araas (2006) | Adams & Araas (2006) | Adams & Araas (2006) | Adams & Colner (2008a) |
| Andes et al. (2012) | Adams et al. (2007) | Adams & Colner (2008a) | Adams & Rust (2006) | Adams et al., (2007) |
| Anderson et al. (2005) | Adams & Colner (2008a) | Adams & Moore (2007) | Anderson et al. (2005) | Adams & Rust (2006) |
| Arbour-Nicitopoulos et al. (2010) | Adams & Rust (2006) | Barry & Piazza-Gardner (2012) | Buhi et al. (2010) | Braithwaite et al. (2010) |
| Barry & Piazza-Gardner (2012) | Barry & Piazza-Gardner (2012) | Becker et al. (2008) | Bulmer et al. (2010) | Duryea & Frantz (2011) |
| Bernert et al. (2012) | Becker et al. (2008) | Blosnich & Bossarte (2012) | Dams-O'Connor et al. (2006) | Eisenmann et al. (2004) |
| Blosnich et al. (2010) | Blosnich et al. (2010) | Braithwaite et al. (2010) | Haines et al. (2006) | Elliot et al. (2012) |
| Blosnich & Bossarte (2012) | Blosnich & Bossarte (2012) | Duryea & Frantz (2011) | Kanekar & Sharma (2008) | Lindley et al. (2008) |
| Buhi et al. (2010) | Bulmer et al. (2010) | Eisenmann et al. (2004) | Kernan et al. (2011) | Mihalopoulos et al. (2008) |
| Bulmer et al. (2010) | Eisenmann et al. (2004) | Gilkey et al. (2010) | Kwan et al. (2010) | Ravert (2009) |
| Dams-O'Connor et al. (2006) | Gilkey et al. (2010) | Gillman et al. (2006) | Lindley et al. (2008) | Zhang et al. (2008) |
| Duryea & Frantz (2011) | Gillman et al. (2006) | Jarrett et al. (2012) | Lindsey et al. (2009) | |
| Kanekar & Sharma (2008) | Jarrett et al. (2012) | Kerr et al. (2013) | McCave et al. (2013) | |
| Kennedy et al. (2008) | Kerr et al. (2013) | Lindley et al. (2008) | Mihalopoulos et al. (2008) | |

Table 2.1 Continued

| Chi-Square | Logistic/linear regression (multivariate, univariate, &/or bivariate) | Odds ratios / Confidence intervals | Independent t-tests | ANOVA |
|---|---|---|---|---|
| Kernan et al. (2011) | Kwan et al. (2010) | Lindley et al. (2009) | Moore et al. (2011) | |
| Kerr et al. (2013) | Leino & Kisch (2005) | Perkins et al. (2005) | Primack et al. (2009) | |
| Kwan et al. (2010) | Lindley et al. (2008) | Primack et al. (2008) | | |
| Lindley et al. (2008) | Lindley et al. (2009) | Primack et al. (2010) | | |
| Lindley et al. (2009) | Lindley et al. (2013) | Primack et al. (2013a) | | |
| Lindsey et al. (2009) | McCave et al. (2013) | Sidani et al. (2013) | | |
| Martens et al. (2006) | Perkins et al. (2005) | Struble et al. (2010) | | |
| McCave et al. (2013) | Primack et al. (2008) | Taliaferro et al. (2009) | | |
| Moore et al. (2011) | Primack et al. (2009) | Trepka et al. (2008) | | |
| Oswalt & Wyatt (2011) | Primack et al. (2010) | Wharton et al. (2008) | | |
| Oswalt & Wyatt (2013) | Primack et al. (2012) | Zullig & Divin (2012) | | |
| Primack et al. (2009) | Primack et al. (2013a) | | | |
| Primack et al. (2010) | Primack et al. (2013b) | | | |
| Primack et al. (2012) | Ravert (2009) | | | |
| Primack et al. (2013a) | Scholly et al. (2010) | | | |
| Primack et al. (2013b) | Struble et al. (2010) | | | |

Table 2.1 Continued

| Chi-Square | Logistic/linear regression (multivariate, univariate, &/or bivariate) | Odds ratios / Confidence intervals | Independent t-tests | ANOVA |
|---|---|---|---|---|
| Ridner et al. (2006) | Taliaferro et al. (2009) | | | |
| Ridner et al. (2010) | Wharton et al. (2008) | | | |
| Taliaferro et al. (2009) | Wilke et al. (2005) | | | |
| Trieu et al. (2011) | Zhang et al. (2008) | | | |
| Trieu et al. (2013) | Zullig & Divin (2012) | | | |
| Turner et al. (2012) | | | | |
| Volicer et al. (2006) | | | | |
| Wharton et al. (2008) | | | | |
| Zhang et al. (2008) | | | | |

Although those listed in Table 2.1 were the most commonly used tests to analyze data from the NCHA I or II, there were many other types of data analyses used for addressing research questions. Correlational tests such as Pearson r (Martens et al., 2006; Andes, Poet, & McWillimas, 2012; Ravert, 2009); Spearman's rho (Trieu, Bratton, & Hopp Marshak, 2011; Adams, Moore, & Dye, 2007); point-biserial correlation (Haines, Barker, & Rice, 2006); and Phi correlation (Buhi, Marhefka, & Hoban, 2010) were used. Goodness of fit tests conducted included Hosmer-Lemeshow (Barry & Piazza-Gardner, 2012; Blosnich, Jarrett, & Horn, 2010; Kim, Trepka, De La Rosa, & Dillon, 2008; Turner, Thompson, Brunner Huber, & Arif, 2012; Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulker, 2010). Researchers from one study utilized generalized estimating equations (Sidani, Shensa, & Primack, 2013).

Of the 72 articles, only nine researchers reported effect sizes in their studies (Duryea & Frantz, 2011; Elliot, Kennedy, Morgan, Anderson, & Morris, 2012; Primack et al., 2012; Primack et al., 2013b; Adams, Wharton, Quilter, & Hirsch, 2008; Nustad, Adams, & Moore, 2008; Dams-O'Connor, Martens, & Anderson, 2006; Bernert, Ding, & Hoban, 2006; Oswalt & Wyatt, 2013). Effect size is a statistic that many journals now require researchers to use when reporting data analysis results and allows researchers to identify the practical significance of their results (Thompson, 2006).

In order to test whether risky behaviors mediate the relationship between relationship status of students and their well-being, researchers in one study utilized structural equation modeling (SEM) (Braithwaite, Delevi, & Fincham, 2010). Researchers in a second study using SEM wished to estimate parameters of a mediation

model (Sawatzky et al., 2012; Blosnich et al., 2010). In addition to SEM, Hierarchical generalized linear modeling was employed in one study to determine the effect of contextual factors on students' binge drinking behaviors (Seo & Li, 2009). Several researchers reported post hoc tests conducted and included Games-Howell (Elliot et al., 2012) and Tukey (Lindley, Barnett, Brandt, Hardin, & Burcin, 2008; Oswalt & Wyatt, 2013) while one study reported a Venn diagram (Primack et al., 2013b). Trend analysis (Vader, Walters, Roudsari, & Nguyen, 2011), and cross-tabs (Ridner, Walker, Hart, & Myers, 2010; Trieu et al., 2011; Oswalt & Wyatt, 2013) were also run.

In addition, the following data analysis tests, techniques, and procedures were conducted: Hox 5-step exploratory procedure (Seo & Li, 2009); Levene's test (Oswalt & Wyatt, 2013); Brown-Forsyth statistic (Oswalt & Wyatt, 2013); Fisher's exact tests (Kernan, Bogart, & Wheat, 2011); Mann-Whitney U tests (Kennedy, Kassab, Gilkey, Linnel, & Morris, 2008); Wald test (Becker, Adams, Orr, & Quilter, 2008; Adams & Colner, 2008; Kim et al., 2008); Cramer's V (McCave, Azulay Chertok, Winter, & Haile, 2013; Oswalt & Wyatt, 2011; Anderson, Martens, & Cimini, 2005; Adams & Araas, 2006; Primack et al., 2012; Primack et al., 2013b; Adams & Wharton, 2008; Nustad et al., 2008; Dams-O'Connor et al., 2006; Bernert et al., 2012; Oswalt & Wyatt, 2013); Somer's D (Nustad et al., 2008); Cohen's d (Elliot et al., 2012; Dams-O'Connor et al., 2006); and Bonferroni approach (Buhi et al., 2010; Elliot et al., 2012; Blosnich et al., 2010; Oswalt & Wyatt, 2013).

*Were psychometric properties addressed and/or measured and if so, how? (Question #3)*

Of the 72 articles, researchers in 22 (30.6%) conducted their own psychometric analysis and included analyses such as principal component analysis (8.3%; n = 6) and Cronbach's alpha for the items of interest (6.9%; n = 5). Researchers from nine of the 72 (12.5%) articles developed their own validity screens such as utilizing omission criteria (for example, researchers in one study implemented inclusion/exclusion criteria such as omitting highly improbable heights [those responses with a mean+4 standard deviations]). Authors of one article looked at similar studies to compare with theirs, and one used bootstrapping. Twenty-three (31.9%) studies did not report any psychometric analysis of the instrument in the published article. Authors from the 23 remaining studies (31.9%) mentioned that reliability and validity testing had been conducted by the ACHA and provided the citation, while researchers from four studies mentioned reliability/validity testing had been indicated in other studies.

Although there was no mention of theory when the NCHA was developed, researchers from 12 of 72 articles provided a theoretical framework on which to base their research. Those researchers who did include a theoretical framework used the following: Classic Stress Paradigm (Leino & Kisch, 2005); Salutogenesis (Becker et al., 2008); Social Norms Theory (Martens et al., 2006; Perkins et al., 2005; Adams & Rust, 2006); Protection Motivation Theory (Ravert, 2009); Socio Ecological Model (Seo & Li, 2009); Theory of Reasoned Action (Primack, Sidani, Carroll, & Fine, 2009); a developmental/contextual framework (Wilke, Siebert, Delva, Smith, & Howell, 2005); and Protective Behavioral Strategies (Araas & Adams, 2008; Martens et al., 2004).

When researchers base their research on a sound theory, they are able to have guidance that direct them to the important questions and can help them make sense of the data collected by an instrument (Neuman, 1997). When a scale, however, such as the NCHA, is not developed with a theory, it is difficult for researchers to think clearly about the constructs being measured (DeVellis, 2012). Further, when "developing and validating a scale, one should not overlook the importance of being well grounded in the substantive theories related to the phenomenon to be measured" (DeVellis, 2012, p. 73). When assessing psychometric properties, therefore, theory is an important consideration.

*What are the limitations of the instrument as identified in the published studies? (Question #4)*

Of the 72 articles meeting the criteria for inclusion in this review, nine consistent limitations utilizing the NCHA I or II were identified in the conclusion/discussion section of the articles reviewed. One limitation of the data collected by the instrument, and listed in ten of the published studies, was overrepresentation of Caucasian females, which can mean any results will not be generalizable to college students across the nation.

Item sensitivity was also listed as a limitation for ten of the published studies. If the items being measured are not sensitive enough to measure what the researcher wants to measure, then the results may not be valid.

Another limitation, listed in four of the articles, was the target audience for the instrument. The NCHA was created to be implemented with undergraduate college

students. Trying to implement it with solely professional or graduate students may not provide the results the researchers are looking to study.

Items from the instrument not being defined well was listed by researchers in 20 of the published articles as a limitation. Because the items on the NCHA I and II were not well defined, definitions of the health behaviors were left up to the participants for interpretation.

Results from the NCHA I and II are mostly measured as nominal or ordinal scales of measurement. This was listed as a limitation of the instrument in six of the articles. For certain types of data analyses, therefore, transformation of the data is necessary in order to conduct these tests. The instrument was designed to get a snapshot of the frequency of reporting of college student behaviors. It was not designed for higher scales of measure data analysis.

Further, there were items that were not covered by the NCHA I or II that would have been helpful for many researchers to aid them in answering their own research questions. This was listed as a limitation in eleven of the published articles.

The NCHA I and II were designed with multiple timeframes for recall items. Participants were expected to answer questions regarding their health behaviors that occurred anywhere from seven days (questions regarding sleep and physical activity) to 12 months (questions regarding immunizations and pregnancy). This would force students to recall behaviors they engaged in a year prior to taking the assessment, potentially resulting in unreliable responses due to the inaccuracy of their memory. The

timeframe necessary for the items on the instrument was listed as a limitation in four of the articles.

Finally, since institutions self-select to implement the instrument, only those schools who are interested in, receive Institutional Review Board approval, implement the questionnaire with either a random sample of student email addresses or a random sample of selected classrooms, and can afford the instrument (the ACHA charges a fee to participate) implement it with their students. This does not allow for generalizability to all students. The self-selection of institutions was listed as a limitation in 18 of the published articles. These limitations of the ACHA-NCHA I and II as indicated by researchers in reviewed articles are presented in Tables 2.2 – 2.10.

Table 2.2

Limitations of the ACHA-NCHA I and II I and II: Overrepresentation of Caucasian Females

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Overrepresentation |
|---|---|---|---|---|---|
| Adams & Araas (2006) | Secondary analysis of reference group | 47,202 | Not reported | I | Overrepresentation of Caucasian students |
| Becker et al. (2008) | Secondary analysis of reference group | 54,111 | Guided by salutogenesis | I | Women overrepresented |
| Duryea & Frantz (2011) | Secondary analysis of reference group | 19,996 | Not reported | I | Women overrepresented |
| Gillman et al. (2006) | Primary data collection | 1,059 | Not reported | I | Women overrepresented |
| Kwan et al. (2010) | Primary data collection | 1,202 | Knowledge mobilization perspective | I | High proportion of females and graduate students |
| Leino & Kisch (2005) | Secondary analysis of reference group | 15,977 | Classic stress paradigm similar to PTSD | I | Women overrepresented |
| Primack et al. (2009) | Primary data collection | 657 | Theory of Reasoned Action | I | Overrepresentation of young females |
| Ridner et al. (2010) | Primary data collection | 741 | Not reported | I | Overrepresentation of Caucasian females |
| Sawatzky et al. (2012) | Primary data collection | 2,147 & 2,292 | Not reported | II | Overrepresentation of women |
| Wharton et al. (2008) | Secondary analysis of reference group | 38,204 | Not reported | I | Overrepresentation of women |

Table 2.3

Limitations of the ACHA-NCHA I and II: Items not Sensitive Enough to Discern Magnitude of Health Behaviors

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: insensitive item(s) |
|---|---|---|---|---|---|
| Blosnich et al. (2010) | Secondary analysis of reference group | 75,164 | Not reported | I | Definition of smoking results makes it difficult to compare to other results |
| Blosnich & Bossarte (2012) | Secondary analysis of reference group | 11,046 | Not reported | II | Measures of victimization/discrimination not specific to sexual minority status |
| Dams-O'Connor et al. (2006) | Primary data collection | 255 | Not reported | I | Desire to lose weight item does not provide information about intensity of desire or about use of dieting behaviors |
| Duryea & Frantz (2011) | Secondary analysis of reference group | 19,996 | Not reported | I | Differences in alcohol-related consequences |
| Jarrett et al. (2012) | Secondary analysis of reference group | 82,155 | Not reported | II | Data limited by responses and questions on instrument of hookah use |
| Moore et al. (2011) | Primary data collection | 83 | Not reported | II | Religiosity items were limited in number and scope |
| Oswalt & Wyatt (2011) | Secondary analysis of reference group | 27,454 | Not reported | II | Unsure responses for sexual orientation may have influenced the results |
| Perkins et al. (2005) | Secondary analysis of reference group | 76,145 | Social norms theory | I | Not possible to determine specific content of alcohol education information provided to students |
| Struble et al. (2010) | Secondary analysis of reference group | 57,903 | Not reported | I | Sexual orientation is self-report (sexual orientation does not always match behavior) |
| Vader et al. (2011) | Secondary analysis of reference group | 94,806 | Not reported | I | Wording of question addressing use of health information (actively seeking or passively getting); treated all kinds of health information as single category |

Table 2.4

Limitations of the ACHA-NCHA I and II: Instrument was Largely Tailored to Undergraduate Students

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: tailored to undergraduates |
|---|---|---|---|---|---|
| Becker et al. (2008) | Secondary analysis of reference group | 54,111 | Guided by salutogenesis | I | Limited to college students |
| Bulmer et al. (2010) | Primary data collection | 448 | Not reported | I | Instrument largely tailored to undergraduates |
| Kernan et al. (2011) | Primary data collection | 1,355 | Not reported | I | Measure developed primarily for undergraduates |
| Taliaferro et al. (2009) | Secondary analysis of reference group | 43,499 | Not reported | I | Sample was only college students |

Table 2.5

Limitations of the ACHA-NCHA I and II: Health Behaviors not Defined Well

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: behaviors not defined well |
|---|---|---|---|---|---|
| Adams et al. (2007) | Secondary analysis of reference group | 47,755 | Not reported | I | Measures of physical activity |
| Andes et al. (2012) | Primary data collection | 442 | Not reported | II | Definitions of varsity, intramural, and club sport did not allow research at subcultures |
| Anderson et al. (2005) | Primary data collection | 391 | Not reported | I | Eating disorders, specifically bulimia nervosa |
| Blosnich et al. (2010) | Secondary analysis of reference group | 75,164 | Not reported | I | Sexual orientation did not include other dimensions of sexual identity |

Table 2.5 Continued

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: behaviors not defined well |
|---|---|---|---|---|---|
| Braithwaite et al. (2010) | Primary data collection | 1,621 | Not reported | I | Did not differentiate between engaged and dating and living together or separate |
| Eisenmann et al.(2004) | Primary data collection | 773 | Not reported | I | Does not clarify moderate to vigorous physical activity (i.e. breathe hard, sweat, etc.); definition and use of BMI |
| Elliot et al. (2012) | Secondary analysis of reference group | 61,011 | Not reported | I | Measures of physical activity in terms of intensity, type, or duration; uses depressive symptoms rather than actual diagnosis |
| Harring et al. (2010) | Secondary analysis of reference group | 94,806 | Not reported | I | Items were not extensive enough to define what is considered "dieting" or differentiate between various kinds of "diet pills" |
| Kennedy et al. (2008) | Primary data collection | 973 | Not reported | I | Low back pain |
| Kernan et al. (2011) | Primary data collection | 1,355 | Not reported | I | Mental health diagnoses/constructs inappropriately measured as global concern |
| Lindley et al. (2008) | Secondary analysis of reference group | 29,952 | Not reported | I | Sexual behaviors not clearly defined; leaving the meaning open to interpretation |
| Lindley et al. (2009) | Secondary analysis of reference group | 25,389 | Not reported | I | Gyn exam |
| Lindsey et al. (2009) | Secondary analysis of reference group | 40,610 | Not reported | II | HPV vaccine did not include time reference nor info on whether they had completed the series |
| Oswalt & Wyatt (2013) | Secondary analysis of reference group | 25,553 | Not reported | II | NCHA does not clearly define sexual behaviors |

Table 2.5 Continued

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: behaviors not defined well |
|---|---|---|---|---|---|
| Primack et al. (2010) | Secondary analysis of pilot test group | 8,745 | Not reported | II | Athletic status and type of sport/intensity played |
| Ravert, (2009) | Secondary analysis of reference group (only students with diabetes) | 450 | Protection motivation theory | I | NCHA does not discriminate between type 1 and type 2 diabetes |
| Seo & Li (2009) | Secondary analysis of reference group | 76,532 | Hierarchical linear modeling | I | NCHA had single operational definition for binge drinking |
| Turner et al. (2012) | Primary data collection | 1,280 | Not reported | I | Descriptive symptomatology scores constructed from instrument by researchers cannot be linked to diagnostic criteria for depression |
| Wharton et al. (2008) | Secondary analysis of reference group | 38,204 | Not reported | I | Differentiate b/w prescription diet pills and OTC and dieting |
| Wilke et al. (2005) | Secondary analysis of reference group | 1,422 | Developmental/ contextual framework | I | Timeframes for alcohol behaviors not well defined (i.e. last time partying – last week? Month? Year?) |

Table 2.6

Limitations of the ACHA-NCHA I and II: Scale of the Items

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: scale of the items |
|---|---|---|---|---|---|
| Araas & Adams (2008) | Secondary analysis of reference group | 29,792 | Protective behavioral strategies | I | Yes/no responses only provides nominal data; alcohol consumption variable is ordinal |
| Dams-O'Connor et al. (2006) | Primary data collection | 255 | Not reported | I | Desire to lose weight coded categorically, not providing information about intensity of desire |
| Duryea & Frantz (2011) | Secondary analysis of reference group | 19,996 | Not reported | I | Use of dichotomous variable allows for negligible differences |
| Kanekar et al. (2008) | Primary data collection | 720 | Not reported | I | Lacked sensitivity for the scales of measurement |
| Kennedy et al. (2008) | Primary data collection | 973 | Not reported | I | Many of the items were categorical in nature, possibly resulting in misclassification errors |
| Martens et al. (2004) | Primary data collection | 556 | Protective behavioral strategies | I | Yes/no format does not provide number of times behaviors experienced |

Table 2.7

Limitations of the ACHA-NCHA I and II: Design of the Instrument

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Design of the instrument |
|---|---|---|---|---|---|
| Buhi et al. (2010) | Secondary analysis of reference group | 44,165 | Not reported | I | Not designed as comprehensive sexual health assessment |
| Gilkey et al. (2010) | Primary data collection | 963 | Not reported | I | Not designed to measure associations but merely identify the problem |
| Gillman et al. (2006) | Primary data collection | 1,059 | Not reported | I | NCHA does not tightly focus on suicide |
| Seo & Li (2009) | Secondary analysis of reference group | 76,532 | Hierarchical linear modeling/Socio-ecological model | I | Not designed as comprehensive alcohol behaviors assessment |
| Trieu et al. (2011) | Primary data collection | 4,487 | Not reported | I | Comprehensive nature makes it difficult to explore all variables |

Table 2.8

Limitations of the ACHA-NCHA I and II: Non-Covered Questions That Would Aid Researchers

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Non-covered questions that would aid researchers |
|---|---|---|---|---|---|
| Adams et al. (2008b) | Secondary analysis of reference group | 43,678 | Not reported | I | Did not measure/include other transmission methods of acute infectious illnesses |

Table 2.8 Continued

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Non-covered questions that would aid researchers |
|---|---|---|---|---|---|
| Anderson et al. (2005) | Primary data collection | 391 | Not reported | I | Did not test for co-morbid disorders with eating disorders (i.e. depression, personality disorder) |
| Buhi et al. (2010) | Secondary analysis of reference group | 44,165 | Not reported | I | SES |
| Kanekar & Sharma (2008) | Primary data collection | 720 | Not reported | I | Failed to address partner characteristics in terms of whether the condom usage differed with main partners, new partners, or casual partners and the type of relationship |
| Kwan et al. (2010) | Primary data collection | 1,202 | Knowledge mobilization perspective | I | Other health-related sources not included such as media personalities, family physician; no information gathered regarding barriers and/or facilitators to obtaining health-related information |
| Mihalopoulos et al. (2008) | Primary data collection | 582 | Not reported | I | Did not compare weight patterns of freshmen with those in similar age group |
| Oswalt & Wyatt, (2011) | Secondary analysis of reference group | 27,454 | Not reported | II | SES |
| Oswalt & Wyatt (2013) | Secondary analysis of reference group | 25,553 | Not reported | II | Does not allow students to list greater than 99 sex partners |
| Trieu et al. (2013) | Primary data collection | 769 | Not reported | II | Sexual partner characteristics; distinguish b/w type of relationship (i.e. engaged, committed and exclusive) |
| Wilke et al. (2005) | Secondary analysis of reference group | 1,422 | Developmental/contextual framework | I | Did not assess other environmental factors affecting college drinking (i.e. bar density or campus alcohol policy) |
| Zhang et al. (2008) | Primary data collection | 1,145 | Not reported | I | Other questions about alcohol consequences such as property damage, getting arrested, & fights |

Table 2.9

Limitations of the ACHA-NCHA I and II: Time Frames of Recall Data Were Inconsistent

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Time frames of recall data were inconsistent |
|---|---|---|---|---|---|
| Araas et al. (2008) | Secondary analysis of reference group | 29,792 | Protective behavioral strategies | I | Recall time frame for alcohol consumption was "the last two weeks to last 30 days" whereas for protective behaviors and negative alcohol-related consequences it was "the last twelve months" |
| Haines et al. (2006) | Secondary analysis of reference group | 29,649 | Not reported | I | Time frames described within different items (last time partied vs. last school year) |
| Wilke et al. (2005) | Secondary analysis of reference group | 1,422 | Developmental/contextual framework | I | Time frames not well defined for alcohol consumption |
| Zullig & Divin (2012) | Secondary analysis of reference group | 22,783 | Not reported | I | Prescription drug use responses were over past 12 months – last 30 days would be more accurate |

Table 2.10

Limitations of the ACHA-NCHA I and II: Self-Selection of Institutions Leads to Selection Bias and Non-Generalizable and Representativeness of Results

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Self-selection of institutions |
|---|---|---|---|---|---|
| Adams et al. (2007) | Secondary analysis of reference group | 47,755 | Not reported | I | Self-selection of institution participation |
| Barry & Piazza-Gardner (2012) | Secondary analysis of reference group | 26,685 | Not reported | I | Institutions self-select |

Table 2.10 Continued

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Self-selection of institutions |
|---|---|---|---|---|---|
| Bernert et al. (2012) | Secondary analysis of reference group | 60,940 | Not reported | II | Institutions self-select to participate |
| Blosnich & Bossarte (2012) | Secondary analysis of reference group | 11,046 | Not reported | II | Selection bias in which schools choose to participate |
| Blosnich et al. (2010) | Secondary analysis of reference group | 75,164 | Not reported | I | Self-selection of institutions |
| Elliot et al. (2012) | Secondary analysis of reference group | 61,011 | Not reported | I | Self-selection of participating institutions |
| Harring et al. (2010) | Secondary analysis of reference group | 94,806 | Not reported | I | Limited generalizability because universities self-select |
| Jarrett et al. (2012) | Secondary analysis of reference group | 82,155 | Not reported | II | Schools self-select |
| Lindley et al. (2009) | Secondary analysis of reference group | 25,389 | Not reported | I | Self-selection of participating institutions |
| Lindley et al. (2008) | Secondary analysis of reference group | 29,952 | Not reported | I | Self-selection of colleges and universities |
| Lindley et al. (2013) | Secondary analysis of reference group | 40,610 | Not reported | II | Self-selection of participating institutions |
| Perkins et al. (2005) | Secondary analysis of reference group | 76,145 | Social norms theory | I | Schools self-select |
| Primack et al. (2010) | Secondary analysis of reference group | 8,745 | Not reported | II | Schools self-select to participate |
| Primack et al. (2012) | Secondary analysis of reference group | 111,245 | Not reported | II | Schools self-select |
| Primack et al. (2013b) | Secondary analysis of reference group | 105,012 | Not reported | II | Not representative because schools self-select to participate |

Table 2.10 Continued

| Reference | Study design | N | Theoretical Framework | NCHA I or II | Limitation: Self-selection of institutions |
|---|---|---|---|---|---|
| Sidani et al. (2013) | Secondary analysis of reference group | 82,251 | Not reported | II | Schools self-select to participate |
| Vader et al. (2011) | Secondary analysis of reference group | 94,806 | Not reported | I | Self-selected schools |
| Zulig & Divin (2012) | Secondary analysis of reference group | 22, 783 | Not reported | I | Schools self-select to participate |

Finally, of the 72 articles, 46 acknowledged self-reported data as a limitation to their studies and 29 reported the cross-sectional design as a limitation to their studies. Although self-reported data and cross-sectional research designs are not limitations of the ACHA-NCHA I or II, these were listed as limitations of the studies in which the NCHA I or II were utilized. By having students self-report, there may be an opportunity for socially desirable answers to be given. Specifically with sensitive topics such as those relating to sexual health, students who are asked questions about partner number, for example, could be indicating one number representing sexual partners on the questionnaire and in reality, be embarrassed by the actual partner number. This socially acceptable response may cause an unwillingness to share the actual number, even though participants are assured the questionnaire is confidential, and in those questionnaires implemented in the classroom, anonymous. Self-reported questionnaires typically result in participants being non-responsive and refusing to answer sensitive questions; or reporting error where the respondent might provide an answer, but there is no assurance the answer accurately represents the behavior. Finally, when cross-sectional designs are used, they allow researchers to gain a one-time glance of what student behaviors on their campus are like, which may not be comparable with other years. A further limitation for the cross-sectional design is that sample size requirements may need to be large if one needs to identify a rare outcome or exposure (Thisted, 2006).

## Discussion

Presented in this systematic review is an investigation of the utilization of the ACHA NCHA I and II in published literature. The findings from this review illuminate

limitations with use of the NCHA I and II with college student populations and the types of research that is being conducted with the data produced by the instrument. This discussion will be organized in the following way: a discussion on the instrument's limitations as listed by researchers in the published literature, recommendations to the ACHA based on the results of this review, limitations of the current review, and finally, implications for the field of Health Education.

## Limitations of the NCHA I and II

### *Overrepresentation*

Despite its popularity there are many common limitations to the questionnaire that were discovered in this review of the literature. First, the questionnaire has been used to collect data on all populations but is overrepresented by the Caucasion female group, which does not match the college student population (Institute of Education Sciences, 2010). Although researchers have indicated females to be more likely to respond to questionnaires than males (Bradburn, 1992; Dey, 1997; Hutchison, Tollefsm, & Wigington, 1987; Krosnick, 1999; Sax, Gilmartin, & Bryant, 2003; Szelenyi, Bryant, & Lindholm, 2005; Underwood, Kim, & Matier, 2000) and minorities to be less likely to respond then those in majority populations (Dey, 1997; Underwood et al., 2003), the findings from this review suggest that the ACHA should attempt to make the results more representative of college students, both male and female, and include a more representative sample of Asian/Pacific Islander, Black, and sexual minority students (i.e. gay, lesbians, and bisexual) in their data set. Perhaps requesting historically black universities and specifically targeting minority populations to implement the ACHA

NCHA II would help the results be more representative of U.S. college students. Further, overrepresentation of Caucasian females does not represent the typical college student as females represent 44.1% of 18-24 college students (2-year and 4-year institutions) in the U.S. and Caucasians represent 43.3% (Institute of Education Sciences, 2010). Those researchers using the NCHA II to gather data about students, therefore, should use caution when trying to present their results as representative of all college students.

*Item sensitivity*

The results of this review suggest that the survey instrument is not sensitive enough to discern the magnitude of the health behaviors it addresses. By having very few questions addressing a health behavior (for example, there is one single question addressing hookah use), researchers may not be able to truly comprehend the seriousness and complexity of the health behaviors they wish to measure. When developing scales, redundancy could be a benefit, and is, in fact, supported by theoretical models used to guide scale development. These models are helpful when instrument developers are attempting to capture a "phenomenon of interest" in order to reveal that phenomena (or behavior) in different ways (DeVellis, 2012). The ACHA should consider segmenting the instrument into multiple smaller ones, allowing researchers to implement a component of the instrument addressing the topic in which they have the most interest, rather than implementing one large instrument. Further, scales that assess health behaviors and ask more than one question to ascertain the frequency and seriousness of behaviors are more likely to be valid and reliable and produce valid and reliable results.

Results from scales with more than one question addressing behaviors are also, therefore, less likely to occur from random error (Henerson, Morris, & Fitz-Gibbon, 1987).

Many behaviors were collapsed by the ACHA into single categories, thus limiting the specificity of responses. For example, in one study using mental health questions as a variable, a limitation indicated that because depression/anxiety/seasonal affective disorder were combined into one question, they were not allowed to identify specific diagnoses and the constructs were inappropriately measured as one global concern (Kernan et al., 2011). Users of the NCHA II should be cautioned when implementing this assessment with regards to the health behavior they want to measure. If researchers wish to comprehend how serious or how frequent a single health behavior is (i.e. hookah usage among college students), then perhaps another instrument would be more beneficial in gathering this information.

*Target audience*

The ACHA NCHA II is implemented on college campuses across the nation, campuses with both undergraduate and graduate students, but is the instrument useful for both of these audiences? Authors from four of the 72 articles indicated this is a limitation; that the ACHA NCHA I and II are solely targeted to undergraduates and is not appropriate to be used with graduate or professional students. For example, Bulmer and colleagues (2010) indicated limitations of the NCHA II because the instrument did not take into account graduate students who are married, have children (there are no questions addressing children on the instrument), and work more hours per week while

attending school. If this is the case, then the ACHA should market the questionnaire as an instrument to be used solely in undergraduate populations. Further, researchers wishing to implement the tool with graduate and professional school student populations should do so with caution and realize the instrument was not created for these populations.

*Definitions of health behaviors*

Defining the health behaviors measured in the questionnaire was listed as a limitation by 20 of the 72 articles. Not defining behaviors well makes it difficult for students to interpret the question and causes participants to utilize their own definitions for behaviors. "If two respondents understand the question to mean different things, their answers may be different for that reason alone" (Fowler, 1993, p. 74). For example, the NCHA I and II do not distinguish between Type I and Type II diabetes, again, leaving the interpretation up to the student respondent (the items refer only to "diabetes"). The measures of physical activity also were not clearly defined, and therefore, students were not able to clearly identify whether they engaged in this behavior. "If respondents do not all have the same understanding of what the questions ask for, error is certain to result" (Fowler, 1993, p. 87). Users of the NCHA II, therefore, should implement the instrument with caution regarding the results of some of the items and understand that participants may be interpreting the questions themselves. To minimize this error, users of the NCHA II may be able to provide definitions for the items to participants.

*Scale of measurement*

Of the four types of measurement scales, the NCHA I and II use three: nominal, ordinal, and interval. In order to conduct data analysis that require data collected at a higher level of scale such as interval or ratio, many researchers had to interpret or change the scale of measurement. Thompson (2006), however, indicates "the only way to recover a higher level of scale is to recollect the data" (p. 20). Further, nominal scale data should not be used for many types of data analyses tests as it is an invitation to inappropriate arithmetic and by assigning numbers, researchers may be premature and invite abuse of statistics (Duncan, 1984). Due to the scale of measurement for the majority of the NCHA I and II items (most responses are nominal or ordinal), some of these methods of analysis may be inappropriate. For example, the assumption for conducting ANOVAs is that there is a mean to compare across three or more groups (Coolidge, 2006). Responses that are nominally or ordinally scaled do not have means and are, therefore, not appropriate to be analyzed using ANOVA (11 groups of researchers utilized ANOVA to analyze their data). The instrument, therefore, is being misused. ACHA should issue a caution to researchers wishing to conduct analyses for higher scales of measurement (i.e. interval) on the data, and researchers should also consider this limitation when identifying the type of analyses they wish to use.

*Design of the instrument*

The NCHA I and II were not created to be an instrument for specifically measuring certain behaviors. For example, researchers needing to measure alcohol behaviors of students may need to utilize a different instrument to gather the true

magnitude of the behaviors in question as the NCHA did not provide enough responses or items for researchers to truly understand the behaviors in question. Further, for researchers wishing to learn about students' mental health status, the NCHA I and II have five questions regarding mental health. For those researchers wanting to study physical activity and nutrition, there are only four questions from which to obtain information regarding students on campus. Developers of the instrument also combined multiple items into single items. For example, depression, anxiety, and seasonal affective disorder, three distinct mental health diagnoses, were combined into a single item on the instrument. Further, Becker and colleagues (2008) noted that the original NCHA designers combined GPA questions into 'C/D/F', a single category rather than separating them out like they did for 'A' and 'B'. There may be significant findings between 'C' students and 'F' students. Again, perhaps there is another instrument that would be better for researchers to implement when addressing certain behaviors that are not well addressed.

*Non-included items that would have aided researchers*

Authors in 12 studies cited non-included items that would have aided them when implementing the NCHA. Questions regarding socio-economic status (SES) of students, for example, would have been beneficial to researchers when studying relationships and differences between behaviors of students coming from low SES compared with those coming from higher SES. Students in the different SES categories may engage in different behaviors. Further, knowing more about the sexual partners of students (whether the partner was a new partner, main partner, or casual partner) and what type of

relationship the student was involved in (stable, committed, or casual) would aid researchers in determining when and in what type of relationships students used protection from sexually transmitted infections (STI) and/or contraception. Students who are in stable relationships may be less likely to use contraception or condoms; however, research indicates stable relationships may be a protective factor in the spread of STIs. Logan, Cole, & Leukefeld (2002) found that individuals in relationships that are casual tend to use more condoms than those who are in monogamous relationships. These individuals may perhaps think sex is riskier in casual relationships than in relationships with a long-term monogamous partner.

When discerning the source of student health information, the instrument leaves out crucial sources such as media and family physicians. Many college students still retain their relationships with their family physicians when attending college so this would be a logical place for them to receive health information. Students are on the internet and watch television more than previous generations did and are likely to obtain information from these sources. Further, there were no items on the questionnaire addressing whether there are any barriers to accessing health information. These barriers may include lack of awareness of services offered on campus as well as the opinion that students may not need the information and, therefore do not seek it out.

With regard to drinking behaviors, questions that would have been beneficial on the instrument would address bar density and campus alcohol policies. Weitzman, Folkman, Folkman, and Wechsler (2003) found that alcohol outlet density was positively correlated with heavy drinking, frequent drinking, and drinking-related problems in

college students. Clapp, Reed, Holmes, Lange, and Voas (2006) found similar results as their data suggested that drinking settings contributed to the amount of alcohol consumed by students. Bar density and campus alcohol policies may have altered the results as those campuses with less strict policies and more bars in the towns may have a higher drinking percentage than others. Further, other consequences of consuming alcohol may have been beneficial to include. There are no questions addressing property damage (either to university property or other), arrests from alcohol issues, or fights between students. The most common secondhand effects of alcohol consumption among college students are property damage, vandalism, fights, and interpersonal violence (Perkins, 2002). These types of consequences can not only affect a student's current standing with the university but also his or her potential for jobs in the present and in the future. Further, colleges and universities end up paying for the effects of student drinking including monetary costs for property damage and also costs in lost tuition from drop outs and failures. College personnel who have to deal with student drinking issues including counseling centers, security, and administrative hearings on specific academic and disciplinary cases, and legal costs are also ways universities and colleges pay for student drinking (Perkins, 2002). Researchers wishing to address more comprehensive alcohol behaviors of students on their campuses should consider implementing a different instrument that can help them grasp the seriousness and frequency of the behaviors in question.

*Time frames of questions*

Over two-thirds of the questions on the instrument have some form of time recall in their wording. The time ranges are seven days to 30 days to 12 months. Students should not be expected to recall behaviors from the previous year as the behaviors engaged in a year prior to participating in the assessment may be forgotten, or students may not recall in detail what they did. Measures that ask respondents how they felt over an extended period of time may also not truly grasp the seriousness of the behavior (Berrett, 1998). It would seem that students would be able to accurately report past behaviors, but that is not always the case.

There are several issues resulting from the use of time referents in measurement scales. First, memory, specifically for college students, tends to fade after time, and people do not usually categorize information or behaviors based on days, months, or years (Dillman, 2000). It may also be useful to include a response indicating "your best guess is fine" in order to eliminate item nonresponse. To address these issues, the ACHA should consider rewording the timeframe questions to reduce both variability of timeframe questions and the length of time recall necessary. Another option would be (because college students seem to think in semester timeframes) perhaps changing the questions to reflect the most recent semesters. Researchers implementing the instrument should also interpret the results on these types of questions with caution, given the amount of recall error the questions may generate.

*Self-selection of institutions and reference group sample size*

In order to participate in the NCHA I and II, institutions of higher education must consent to take part, ordering the assessment through the American College Health Association. This self-selection of institutions is how the ACHA compiles the reference group data set (all data collected by researchers at institutions that choose to participate in implementing the instrument on their campuses in a single semester are combined into a single reference group data set for that semester). Because of the self-selective nature of the assessment, however, the reference group dataset is not generalizable to the nation's college students. ACHA clearly takes the position that NCHA I and II are meant to be used for comparison only, not to generalize results to the nation's college students. This practice begs the question, why develop an instrument if institutions choose to implement it, making the results, therefore, not generalizable to the nations' college students? Further, researchers from thirty of the 72 articles collected primary data on their campuses. These primary data sets resulted in samples sizes of less than 1,500 students each. Conversely, the institutions that utilized the secondary data analysis had sample sizes upwards of 100,000 students. While smaller sample sizes are not necessarily a critical issue, the sample sizes used in the secondary studies were extremely large and by using a large enough sample size, one can achieve any level of statistical significance (i.e., incur a substantial amount of Type I error) (Lykken, 1968). Those researchers with small sample sizes, however, may still be able to find large practical significance (effect size) without finding statistical significance (Coolidge, 2006). Perhaps the ACHA should take a clear position that this instrument is to be used

for comparison and behavior identification or frequency only and researchers implementing the NCHA II should be cautious that the results are not generalizable to all college populations.

*No mention of theory*

When utilizing instruments based on a theoretical framework, the researcher more easily bases his or her research on theory. Although construct validity analyses can be interpreted as theory (DeVellis, 2012), there was no specific theory mentioned by ACHA when developing the original NCHA. Having a theoretical framework for developing instruments could play a key role in conceptualizing measurement problems. With no reported theories in developing the initial NCHA and when researchers use the instrument for a study, it is difficult to have a framework for that study to aid in choosing variables to investigate if there is no sound theory on which the instrument is based (DeVellis, 2012). Researchers in 12 of 72 studies based their study on a theoretical framework. "Relevant social science theories should always be considered before developing a scale…and…poor measurement imposes a limit on the validity of the conclusions on the scale" (DeVellis, 2012). At the very least, investigators must specify a theoretical model to guide scale development (DeVellis, 2012). To the researcher's knowledge, none of this occurred with the original NCHA as the scale was being developed.

*Data analyses*

Thompson (2006) indicates "reporting and interpreting effect sizes in the context of previously reported effects is essential to good research" (p. 187). Only nine of 72

(12.5%) reviewed studies reported effect sizes. Within the 72 articles, 32 different types of data analyses were conducted. In a single study, the use of multiple data analyses could potentially result in an increased chance of alpha (Type I) inflations as the nominal alpha level increases when the number of statistical tests conducted on a given data set is also increased (Institute for Digital Research and Education [IDRE], 2013). The ACHA, therefore, should caution users to limit the number of data analyses conducted on the data sets, and users should be aware that the instrument was created mainly as a needs assessment tool and not for more sophisticated data analyses such as structural equation modeling.

## Recommendations Summary

After conducting this review, there are several recommendations to improve use of the NCHA II instrument.

(1) Instrument developers should create instruments, so researchers can collect the data at a higher level of scale in order to prevent having to transform the data. Data collected at higher levels of scale such as interval or ratio contain all the information unique to that level in addition to all the information present in the lower levels of scale (Thompson, 2006). As indicated above, transforming data may lead to a misinterpretation of results and data needing to be analyzed at higher scales of measurement should be recollected rather than transformed. "If we perform a calculation that requires more information than is present in our data, the resulting characterization will be meaningless or erroneous" (Thompson, 2006, p. 13).

(2) The ACHA should use behavioral theory in redeveloping the tool. Basing a measurement tool on a sound theory would aid researchers in basing their own research on a theoretical framework.

(3) The ACHA should consider defining health behaviors more clearly. Many of the behaviors researchers hope to measure using the NCHA I or II are not clearly defined; leaving interpretation up to the participant. For example, the demographic questions "What is your marital status?" and "What is your relationship status?" allow students to respond as single and in a relationship and living/not living together, respectively. The responses by participants, however, do not allow students to say they are involved in a long term, mutually monogamous relationship. Further, students indicating they have had sexual intercourse do not get to mention what type of relationship they were in when they engaged in this behavior. Were they in a long term relationship or was it a one night stand? The instrument does not allow for these types of responses.

(4) According to the ACHA, the NCHA II takes approximately 30 minutes to complete. Many researchers and participants, however, claim it can take longer than that. Students may not be willing to sit at a computer and participate in a questionnaire for longer than 30 minutes. The ACHA should consider reducing the length of the instrument by assigning subsets of questions. By doing this, participants may be more willing to complete the questionnaire. This may make it more complex and could reduce the precision of estimates of those variables (Fowler, 1993).

(5) The ACHA should consider adding questions addressing socioeconomic status of students, type of sexual partner, barriers to health communication, and consequences related to alcohol consumption, and alcohol mixed with energy drinks. By adding these questions, it allows researchers to further answer their research questions regarding the health behaviors of their students. By doing this, however, the NCHA II would be longer and take more time to complete. Perhaps segmenting the questionnaire into several unique scales would alleviate both of these issues.

(6) Finally, the ACHA should consider shortening the timeframe recalls for those relevant questions to allow students to grasp their behaviors better with shorter timeframes for recall. Further, by "keeping recall simple and related to recent events helps to produce high quality survey data" (Dillman, 2000, p. 37).

## Limitations

The purpose of this review was to synthesize the literature indicating use of the ACHA NCHA I and II in research studies conducted on college campuses across the U.S. and Canada. This review provides recommendations on the use and the improvement of this widely used and popular survey instrument. Despite the potential usefulness of the review, there are limitations that need mentioning. It is possible that articles were missed through the search process or overlooked in the screening process. It is also possible that articles meant to be excluded were included in the review by mistake. Second, the review was limited to empirical studies published in peer-reviewed academic journals. Future reviews should consider expanding the search to include

paper presentations, reports, and dissertations/theses in order to discover more information regarding the limitations of the NCHA I and II.

## Implications for Health Education

The ACHA NCHA II is a widely used and popular instrument. Although this review found several limitations related to use of the instrument with college students, it is currently the only measure available for use in this population.

For replication of this review, researchers may want to include open-access, non-peer-reviewed articles and dissertations to determine their impact on "bottom drawer bias" and with the recommendations mentioned in this review, it is possible to improve upon the NCHA II and its use. The instrument, or one like it, needs to be used by health educators practicing in the field on college campuses. It would allow them to assess the health behaviors of the students on their campuses as well as be able to justify to administrators where and why funding should be spent on health programming on campus. It would also allow for relationship studies between behaviors. Researchers can then potentially determine where the focus should be with regards to programming and allow the ability to identify what factors (i.e. demographic and/or behavioral) are related to which health behaviors in this population. As suggested in this review, however, the instrument should not be used for data analyses for higher scales of measurement (i.e. interval) such as structural equation models and ANOVA. The assessment is a tool to have in the toolbox, but researchers and practitioners need to ensure it is the proper tool to use to answer the questions they wish to answer.

# CHAPTER III

# REVISITING THE PSYCHOMETRIC PROPERTIES OF THE AMERICAN COLLEGE HEALTH ASSOCIATION NATIONAL COLLEGE HEALTH ASSESSMENT II

## Introduction

Professionals working in the arena of college health have used many tools to assess the health behaviors of the college student population including the Harvard College Alcohol Study (Wechsler & Nelson, 2008) and the Centers for Disease Control and Prevention's College Health Risk Behavior Survey (Douglas et al., 1997). One tool that is currently being utilized with today's students is the American College Health Association's National College Health Assessment (ACHA NCHA) II.

The NCHA II is a recognized health assessment tool initially developed in 1999 by an interdisciplinary team of college health professionals. It was created for use by health professionals and researchers working at institutions of higher education and was developed to cover seven content areas for health behaviors found among college students: 1) health, health education, and safety; 2) alcohol, tobacco, and drugs; 3) sex behavior, perceptions and contraception; 4) weight, nutrition and exercise; 5) mental and physical health; 6) impediments to academic performance; and 7) demographics. These seven areas of content are covered with 300 questions (American College Health Association [ACHA], 2004). Data resulting from administration of this instrument are related to students' health habits, behaviors, and perceptions (ACHA, 2013a). The ACHA NCHA II consists of questions taken from a variety of adolescent health-based

questionnaires including the Centers for Disease Control and Prevention's Youth Risk Behavior Surveillance. In order to select items for the NCHA II, a team of interdisciplinary health professionals working in college health matched questions covering specific health behaviors to those behaviors that typically exist among college student populations.

As the psychometric properties of the ACHA NCHA II are examined, the researchers considered several guiding principles for instrument development. Typically, instruments are created for two reasons: (1) to describe given phenomenon; to detect how much of the phenomenon is occurring, and (2) to predict the phenomenon; to investigate future performance or state of the phenomenon for the purpose of making a decision (Henerson et al., 1987).

Many factors affect the ability of an instrument to measure what it intends to measure. First, answers to questions may be affected by the manner in which the questions are asked (Presser et al., 2004). The type of items and responses, questions delivered as open-ended, with time recall, on a Likert-type scale, or as multiple choice, must be considered. The manner, therefore, in which questions are presented must be taken into consideration. Second, key indicators, or factors impacting the quality of an instrument and the data that the instrument produces, are traditionally validity and reliability (Kimberlin & Winterstein, 2008). Third, structural elements affect measurement. For example, words, layout and design, and overall structure impact the data quality (Presser et al., 2004). Instruments must make sense to the participant/respondent and must produce quality data for the researcher. As the

psychometric properties of the NCHA II are examined, the researchers also looked at those factors beyond the actual instrument items.

The ACHA completed a report in 2004 and again in 2008 measuring these indicators of the NCHA I and II, respectively. The properties studied included measurement validity, construct validity, and inter-item reliability. Measurement validity is defined as "the degree of fit between a construct and its indicators" (ACHA, 2008b, p. 4). Measurement validity is found if replication occurs and the results are generalizable to the population from which the measurements were taken. The ACHA found the NCHA I resulted in a very similar pattern of responses when compared to the College Alcohol Survey (CAS), which demonstrates the NCHA I may be comparable to a nationally generalizable database (ACHA, 2004). Clearly, the ACHA has gone to great lengths to assure the quality of the data produced by both the NCHA I and NCHA II.

The ACHA also examined the construct validity of the NCHA I and II. Construct validity is determined to assess whether an indicator actually captures the meaning of the construct of interest (Neuman, 1997) and whether it "behaves" the way it should in regards to the theory upon which it was based (DeVellis, 2012). The ACHA's examination, however, was carried out in the absence of any expressed theory grounding the NCHA I or II. Instead, replication of findings was considered as criteria for construct validity (ACHA, 2008b).

The ACHA also conducted a principal component analysis to determine groups of related items and to provide a structure for conducting a reliability analysis (ACHA,

2008b). This analysis identified Eigenvalues that were acceptable which led to a reliability analysis producing standardized alphas and inter-item correlations (ACHA, 2008b). The primary purpose of these analyses was to demonstrate reliable items to confirm that individual researchers who were using the ACHA NCHA II were obtaining similar results when using the instrument on their campuses (ACHA, 2008b).

To measure inter-item reliability, the ACHA compared Cronbach's alphas of overlapping or common items of the NCHA II and the National College Health Risk Behavior Survey (1995) developed by the Centers for Disease Control and Prevention in collaboration with representatives in universities, national health organizations, and federal agencies. The ACHA also compared the NCHA II's Cronbach alphas of overlapping or common items with the Harvard School of Public Health College Alcohol Study (Wechsler, Lee, Kuo, & Lee, 2000), surveying students in 130 colleges and the US Department of Justice – National College Women Sexual Victimization Study 2000 (Fisher, Cullen, & Turner, 2000). Further, ACHA compared the NCHA I 1998, spring 1999, and fall 1999 pilots with the NCHA I spring 2000 implementation on college and university campuses. For the NCHA II, the ACHA used pilot data set from spring 2009 and spring 2010 to conduct principal components factor analyses and these results provided a structure for reliability analyses (ACHA, 2008b).

Although the ACHA has implemented procedures to ensure the quality of not only NCHA II but also the quality of the data produced, and results of their analyses indicate the instrument is both valid and reliable, validation should be examined routinely as one measures not just the instrument itself, but rather the use of the

instrument (Nunnally, 1978). These ACHA efforts to establish validity and reliability will be considered as the researcher re-examines the psychometric properties of the ACHA NCHA II.

When developing measurement tools for implementation in the social sciences, there are other instrument-associated factors that should also be considered. First, theoretical foundations must be considered when developing an instrument. Crocker and Algina (1986) noted that "constructs cannot be defined only in terms of operational definitions but must also have demonstrated relationships to other constructs or observable phenomena" (p. 7). Having a solid theoretical background for the measurement scale should always be considered before developing a scale, and in essence, at least a tentative theoretical model should serve as a guide to its development (DeVellis, 2012). Second, the level of specificity, whether the constructs are intended to measure very specific behaviors or general items, should also be considered, and variables that match in level of specificity will most strongly relate to each other (DeVellis, 2012). Finally, being clear about what the developers intend to measure can aid in scale development and should be considered (DeVellis, 2012). For example, DeVellis (2012) indicates that when measuring a general construct such as anxiety, developers will be fine if they wish to consider test anxiety and social anxiety to be covered by this general construct. If they wish, however, to add both test anxiety and social anxiety as two different items on their scale, it could be problematic as similar items may tap different constructs. Researchers should be cautious as the purpose of their scale may be to measure one phenomenon, but it may be sensitive to others

(DeVellis, 2012). As the psychometric properties of the NCHA II are examined, the researcher will also examine these instrument associated factors.

Despite the efforts by the ACHA to assure the NCHA II produced valid and reliable data, there was no mention by the ACHA in their validity and reliability analyses of instrument-associated factors such as theoretical foundation, level of specificity, or scale of the measured items. There was also no mention in the reports of factors beyond the actual instrument such as the overall layout, timeframes of questions, and other structural elements. Further, limitations of the instrument have been noted by several studies in which the instrument was used for data collection on various college campuses across the U.S. and Canada. Limitations mentioned by the authors include instrument design (Buhi et al., 2010; Gilkey et al., 2010; Gillman et al., 2006; Seo & Li, 2009; Trieu et al., 2011); scale of the items measured (Araas & Adams, 2008; Dams-O'Connor et al., 2006; Duryea & Frantz, 2011; Kanekar & Sharma, 2008; Kennedy et al., 2008; Martens et al., 2004); poorly defined behaviors (Adams et al., 2007; Andes et al., 2012; Anderson et al., 2005; Blosnich et al., 2010; Braithwaite et al., 2010; Eisenmann et al., 2004; Elliot et al., 2012; Harring, Montgomery, & Hardin, 2010; Kennedy et al., 2008; Kernan et al., 2011; Lindley et al., 2008; Lindley et al., 2009; Lindsey et al., 2009; Oswalt & Wyatt, 2013; Primack et al., 2010; Ravert, 2009; Seo & Li, 2009; Turner et al., 2012; Wharton et al., 2008; Wilke et al., 2005;); and insensitive items (Blosnich et al., 2010; Blosnich & Bossarte, 2012; Dams-O'Connor et al., 2006; Duryea & Frantz, 2011; Jarrett et al., 2012; Moore et al., 2011; Oswalt & Wyatt, 2011; Perkins et al., 2005; Struble et al., 2010; Vader et al., 2011) (see Chapter II results for full list of limitations).

Similarly, researchers using the NCHA I and II have identified limitations in the instrument's ability to capture specific characteristics of certain behaviors. Researchers claim, for instance, that many items were not sensitive enough to thoroughly measure the behaviors in question. By having very few questions addressing a health behavior (for example, there is one single question addressing hookah use), researchers may not have been able to truly comprehend the seriousness, frequency, and complexity of the health behaviors they wished to measure. For example, Eisenmann et al., (2004) noted the questions regarding physical activity were not enough to completely understand the behavior of college students. Blosnich and Bossarte (2012) indicated that since only one item on the questionnaire addressed discrimination, it would limit the ability to assess whether the measure reliably addressed potentially multidimensional variables (i.e., family problems).

Data collected by the NCHA II were collected primarily on two scales of measurement, nominal or ordinal, thereby, disallowing many types of data analyses where interval or ratio scale data is necessary. According to Thompson (2006), data collected at higher levels of scale such as interval or continuous contain all the information unique to that level in addition to all the information present in the lower levels of scale. Thompson (2006) further indicates "the only way to recover a higher level of scale is to recollect the data" (p. 20).

Other researchers using the NCHA I or II discovered that the developers of the instrument did not define some of the behaviors in question very well; allowing participants to interpret the questions in their own ways which may have invalidated the

data (see Chapter II results section). For example, Blosnich et al. (2010) indicated that the sexual orientation questions did not include other dimensions of sexual identity, allowing students to place themselves into categories in which they may not belong. Braithwaite et al. (2010) also indicated the demographic question regarding relationships did not differentiate between engaged, dating, or living together. Eisenmann et al. (2004) indicated the definition and use of body mass index was up to the participant's interpretation.

## Purpose

The purpose of the current study is to re-examine whether the ACHA NCHA II exhibits adequate psychometric properties to be used as both a surveillance and research tool by investigating these factors that are instrument-related, factors that influence the quality of the data, and factors beyond the actual instrument.

## Methodology

This study of the psychometric properties of the ACHA NCHA II was designed to examine instrument-related factors (i.e. theoretical foundation, level of specificity, intended use), factors regarding the quality of the data collected using the instrument (i.e. validity and reliability), and factors beyond the actual instrument items (i.e. how questions are asked, words used, layout). A secondary analysis of data obtained during normal use (implementation on a college campus during three spring semesters by health educators working in the Student Health Services of a large public institution in the southern U.S.) provided insight into the factors cited above.

More than 825,000 students at approximately 550 two-year and four-year public and private institutions from varied geographical regions have participated in the survey since its inception in 2000 (ACHA, 2013b). The ACHA offers both a paper and web questionnaire from which researchers may choose and implementation occurs during both fall and spring semesters. Researchers may choose to randomly select classrooms for implementation of the paper-based instrument, or they may choose to randomly select student emails for the web-based implementation. Only institutions who randomly select classrooms or students were included in a reference group for further analyses. The data used for this study were collected through randomly selected student emails. The instrument, as well as data from a practical application through implementation, was studied.

## Data Collection

The data for this secondary analysis were collected during the spring semesters of 2009, 2011, and 2013. Health educators working at the institution for this study had administered the NCHA or NCHA II six times since 2001 (NCHA – 2001, 2005, and 2007; NCHA II – 2009, 2011, 2013). Only data from the NCHA II implementations were utilized for the current study. Permission to use the data for secondary analysis was requested and granted from the director of the campus health center, the supervisor of the health educators who originally collected the data. All identifying properties of participants from the original data collection were destroyed after data collection was complete and permission given to the ACHA to do so.

The ACHA-NCHA (the original from 2000-2008 and the NCHA II since 2008) has been implemented on college campuses since 2000 and reportedly takes around 30 minutes to complete, containing yes/no type responses as well as Likert scaling. The three data set, from spring 2009 (n = 1,208), spring 2011 (n = 815), and spring 2013 (n = 567) were collected and combined to form a single dataset with an n = 2,509. The three data sets were comparable in both study design (cross-sectional) and in collection methods (web-based). In order to conduct the type of analyses necessary for the current study, the sample needed to be large enough for exploratory purposes, which would allow the researcher to obtain more stable and precise results as well as achieve greater statistical power (Meyers, Gamst, & Guarino, 2013). Further, while the data were collected in a cross-sectional design, there were no events that would make these cohorts significantly different, and as the current study is a secondary analysis, it is appropriate to combine the data set (Orsi et al., 1999). Finally, chi-square tests of independence conducted indicated the samples were appropriate to combine. The researcher investigated five variables: gender, age, general health, relationship status, and year in school in order to determine appropriateness of combining the data set. The results of the chi-square tests are listed in Table 3.1. Significance was set at $p < .05$. All of the variables were less than .05; therefore, it was appropriate to combine the data set both theoretically and empirically. Because the data were used in a secondary analysis, the current study was considered exempt by the school's Intuitional Review Board.

Table 3.1

Chi-square Tests of Independence Across Data Sets

| Variable | Pearson Chi-Square Value | df | *p* |
|---|---|---|---|
| Gender | 23.111 | 4 | .000 |
| Age | 193.609 | 56 | .000 |
| General health | 24.470 | 10 | .006 |
| Relationship status | 15.930 | 4 | .003 |
| Year in school | 191.434 | 12 | .000 |

## Data Analysis

In order to assess the psychometric properties of the NCHA II, several methods were utilized and are described in the testing phases below. Prior to initializing data analyses, however, an item mapping grid was generated utilizing Microsoft Excel®, and questions from the NCHA II were grouped into similar categories by the researcher. Items were combined to form 17 summated variables with each variable containing similar items from the instrument.

Because the majority of responses were either nominal or ordinal scaled, in order to conduct factor analysis and other analyses, the researcher combined the items to treat item responses as higher scaled data (for example, all questions on the NCHA II related to weight, nutrition, or exercise were combined to form a single weight/nutrition/exercise variable). By totaling the scores for a group of items (containing both nominal and ordinal data), the total score then was treated as interval. This type of combination is supported by Nunnally & Bernstein (1994) who indicate that "those who perform such operations thus implicitly use a scaling model to convert data

from a lower (ordinal) to a higher (interval) level of measurement when they sum over items to obtain a total score" (p. 16). After items were mapped into the 17 variables, analyses were conducted in three phases. All analyses were conducted using SPSS version 22.0 (SPSS, Inc., Chicago, IL).

After arranging the data for analysis, frequency distributions were produced for each variable. Three of the 17 variables were normally distributed (harm reduction; mental health; and perceptions), ten variables were positively skewed (safety; personal violence; weight/nutrition/exercise; illness and injury; academic performance; sleep; negative experiences; alcohol; tobacco; and other drug use), two had a bimodal distribution (general health behaviors and sexual behaviors), and two were not normally distributed (education and interest in education).

## Testing Phases

In the first phase, an expert panel review was conducted to assess content validity. During the second phase, a factor analysis using principal axis factoring, Kaiser-Meyer Olkin Measure of Sampling Adequacy, Bartlett's test of sphericity, and a promax oblique rotation were conducted to address construct validity. The third phase assessed internal consistency of the scales' scores conducting Cronbach's alpha on the 17 variables created by combining like items from the instrument.

### *Phase 1 – Assessment of content validity*

Validity is often defined as "the extent to which an instrument measures what it purports to measure" (Kimberlin & Winterstein, 2004, p. 2278). Validity can also consist of the extent to which the measurement tool is being used for its intended

purpose (Kimberlin & Winterstein, 2004). In order to assess the content validity of the NCHA II, to measure whether it covers appropriate areas of college health behaviors and measures what it is supposed to measure, a panel discussion by experts was conducted. A convenience sample (n = 4) of health and measurement professionals was recruited via email to participate in a brief discussion of the instrument. The experts were asked to specifically address the instrument's: (1) application as both a surveillance tool and a research tool, (2) limitations, (3) ability to produce high quality data, and (4) potential 'red flags' or problems with implementation and data analyses. The conversation was recorded and later transcribed.

*Phase 2 – Assessment of construct validity*

In order to assess construct validity of the NCHA II, a principal component exploratory factor analysis was conducted. The goal of the analysis was to select items from the survey instrument that related to a chosen construct (Gorush, 1997). By conducting factor analysis, one can group items measuring similar constructs as well as identify the fewest possible constructs needed to reproduce the original data (Gorush, 1997). The analysis can identify the relationships of variables to each factor, identify if the item from the questionnaire is related to one construct (factor) or more than one construct (Gorush, 1997), and is intimately involved in determining the validity of a scale (Nunnally, 1978). Principal axis factoring with a promax oblique rotation was conducted as well as a review of the Kaiser-Meyer Olkin Measure of Sampling Adequacy and Bartlett's test of sphericity was conducted to determine if the sample data were suited for factor analysis. These analyses were chosen over principal components

analysis with a varimax rotation because the researcher believed the factors produced would be correlated and would produce a shared variance over a unique variance as well as achieve a "better" estimate of the shared variance (Costello & Osborne, 2005; Meyers et al., 2013). Further, if some of the factors are correlated in the high .3s or better, most researchers would opt for the oblique rotation (Meyers et al., 2013).

*Phase 3 – Assessment of internal consistency*

Internal consistency is based on the assumption that items measuring the same construct should be correlated (Kimberlin & Winterstein, 2004). In order to assess internal consistency reliability, Cronbach's alpha was utilized. After the 17 variables were created, Cronbach's alpha was run on each of the variables.

## Missing Data

It was important to be as conservative as possible in identifying the critical factors for the psychometric analysis of this study. In the psychometric analyses, if missing data represented less than 10% of the total cases, the researcher chose to use the SPSS default of listwise deletion. If there were more than 10% of cases with missing data, the researchers employed pairwise deletion. Missing data were further handled by recoding the data with a "dummy variable" in order for SPSS to ignore the cases. Missing data analysis is described in Table 3.2.

Table 3.2

Missing Data Analysis for 17 Created Variables

| Variable | Total missing | Total cases | Percentage missing |
|---|---|---|---|
| General health | 207 | 2,383 | 8.0% |
| Education | 123 | 2,467 | 4.7% |
| Interest in education | 12 | 2,578 | 0.5% |
| Safety | 35 | 2,555 | 1.4% |
| Personal violence | 51 | 2,593 | 2.0% |
| Sexual health | 188 | 2,402 | 7.3% |
| Alcohol | 11 | 2,579 | 0.4% |
| *Harm reduction | 127 | 1,021 | 11.1% |
| **Negative experiences | 765 | 1,825 | 29.5% |
| Academic performance | 344 | 2,246 | 13.3% |
| Injury / illness | 95 | 2,495 | 3.7% |
| Weight / nutrition / exercise | 98 | 2,492 | 3.8% |
| Tobacco | 9 | 2,581 | 0.3% |
| Other drug | 116 | 2,474 | 4.5% |
| Mental health | 208 | 2,382 | 8.0% |
| Perceptions | 234 | 2,356 | 9.0% |
| Sleep | 20 | 2,570 | 0.8% |

*Harm reduction variable only included those students who indicated they used a method of birth control the last time they had vaginal sex
**Negative experiences variable only included those students who indicated they consumed alcohol

## Results

The aggregate sample (n = 2,509) had a mean age of 21.23 (SD = 3.53) years of age. Females comprised 62% (n = 1,586) of the sample while males represented 38% (n = 964) of the sample. Participants were distributed across academic years with 22% (n = 564) first-year undergraduates, 20% (n = 505) second-year undergraduates, 23% (n = 592) third-year undergraduates, 17% (n = 445) fourth-year undergraduates, 5% (n = 114) in their fifth year or more of undergraduate work, and 13% (n = 328) in a graduate/professional school program or not seeking a degree. The vast majority of the sample were Caucasian (n = 1,937; 75%) followed by Hispanic or Latino/a (n = 356;

14%), Asian or Pacific Islander (n = 222; 9%), Black/non-Hispanic (n = 80; 3%), and American Indian, Alaskan Native, Native Hawaiian (n = 30; 1%). Three percent (n = 71) of respondents indicated that they were biracial or multiracial. A comparison of demographic characteristics of the samples and the corresponding campus population is listed in Table 3.3. Within the sample, there was an overrepresentation of female students (researchers, however, have indicated females to be more likely to respond to questionnaires than males [Bradburn, 1992; Dey, 1997; Hutchison et al., 1987; Krosnick, 1999; Sax et al., 2003; Szelenyi et al., 2005; Underwood et al., 2000]), full-time enrollment status, Asian/Pacific Islander students, and 18-21 year old age group as well as an underrepresentation of graduate students in the 2011 sample.

Table 3.3

Sample and Population Comparison for Corresponding Years

| | 2009 Sample (n = 1,208) | | 2009 Population (n = 44,720) | | 2011 Sample (n = 815) | | 2011 Population (n = 46,422) | | 2013 Sample (n = 567) | | 2013 Population (n = 47,061) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | n | (%) | n | (%) | N | (%) | n | (%) | n | (%) | n | (%) |
| Gender | | | | | | | | | | | | |
| Female | 724 | 59.9% | 21,039 | 47.0% | 545 | 66.9% | 21,619 | 46.6% | 317 | 55.9% | 22,173 | 47.1% |
| Male | 464 | 38.4% | 23,681 | 53.0% | 257 | 31.5% | 24,803 | 53.4% | 243 | 42.9% | 24,888 | 52.9% |
| Transgender | 0 | 0.0% | --- | --- | 2 | 0.2% | --- | --- | 2 | 0.4% | --- | --- |
| Missing | 20 | 1.7% | --- | --- | 11 | 1.3% | --- | --- | 5 | 0.9% | --- | --- |
| Full-time students | | | | | | | | | | | | |
| Yes | 1,140 | 95.7% | 39,120 | 87.5% | 776 | 96.6% | 40,297 | 86.8% | 534 | 95.5% | 40,090 | 85.2% |
| No | 44 | 3.7% | 5,600 | 12.5% | 22 | 2.7% | 6,124 | 13.2% | 23 | 4.1% | 6,971 | 14.8% |
| Missing | 17 | 1.4% | --- | --- | 12 | 1.5% | --- | --- | 8 | 1.4% | --- | --- |
| Year in School | | | | | | | | | | | | |
| 1st year undergrad | 267 | 22.5% | --- | | 172 | 21.3% | --- | | 125 | 22.4% | --- | |
| 2nd year undergrad | 229 | 19.3% | --- | | 188 | 23.3% | --- | | 88 | 15.8% | --- | |
| 3rd year undergrad | 250 | 21.0% | --- | | 224 | 27.8% | --- | | 118 | 21.2% | --- | |
| 4th year undergrad | 173 | 14.6% | --- | | 185 | 23.0% | --- | | 87 | 15.6% | --- | |
| 5th year or more undergrad | 47 | 4.0% | --- | | 34 | 4.2% | --- | | 33 | 5.9% | --- | |
| Graduate | 221 | 18.6% | 9,055 | 20.2% | 2 | 0.2% | 9,470 | 20.4% | 105 | 18.9% | 9,533 | 20.3% |
| Not seeking a degree | 1 | 0.1% | --- | --- | 1 | 0.1% | --- | --- | 1 | 0.2% | --- | --- |
| Missing | 20 | 1.7% | --- | --- | 9 | 1.1% | --- | --- | 10 | 1.8% | --- | --- |

Table 3.3 Continued

| | 2009 Sample (n = 1,208) | | 2009 Population (n = 44,720) | | 2011 Sample (n = 815) | | 2011 Population (n = 46,422) | | 2013 Sample (n = 567) | | 2013 Population (n = 47,061) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | n | (%) | N | (%) | n | (%) | N | (%) | n | (%) | N | (%) |
| Age | | | | | | | | | | | | |
| 18-21 | 803 | 67.2% | 21,303 | 47.6% | 651 | 80.5% | 21,794 | 47.0% | 374 | 66.5% | 22,153 | 47.1% |
| 22-25 | 261 | 21.8% | 16,416 | 36.7% | 143 | 17.7% | 17,338 | 37.3% | 122 | 21.7% | 17,506 | 37.2% |
| 26-30 | 81 | 6.8% | 3,859 | 8.7% | 12 | 1.5% | 4,088 | 8.8% | 45 | 8.0% | 4,174 | 8.9% |
| 31+ | 50 | 4.2% | 3,138 | 7.0% | 3 | 0.4% | 3,198 | 6.7% | 21 | 3.7% | 3,222 | 6.9% |
| Missing | 13 | 1.1% | --- | --- | 6 | 0.7% | --- | --- | 5 | 0.9% | --- | --- |
| Race or ethnicity | | | | | | | | | | | | |
| White, Non-Hispanic | 905 | 74.9% | 31,602 | 70.7% | 615 | 75.5% | 31,092 | 67.0% | 417 | 73.5% | 30,302 | 64.4% |
| Black, not Hispanic | 39 | 3.2% | 1,446 | 3.2% | 23 | 2.8% | 1,607 | 3.5% | 18 | 3.2% | 1,563 | 3.3% |
| Hispanic or Latino/a | 131 | 10.8% | 5,548 | 12.4% | 132 | 16.2% | 6,719 | 14.5% | 93 | 16.4% | 7,643 | 16.2% |
| Asian/Pacific Islander | 113 | 9.4% | 1,888 | 4.2% | 49 | 6.0% | 2,055 | 4.4% | 60 | 10.6% | 2,247 | 4.8% |
| Am Indian/Alaskan | 6 | 0.5% | 245 | 0.5% | 11 | 1.3% | 160 | 0.3% | 13 | 2.3% | 129 | 0.3% |
| Biracial/Multiracial | 34 | 2.8% | --- | --- | 21 | 2.6% | --- | --- | 16 | 2.8% | --- | --- |
| Other | 14 | 1.2% | 182 | 0.4% | 14 | 1.7% | --- | --- | 6 | 1.1% | --- | --- |

## Instrument-Related Factors

*Phase 1 – Assessment of content validity*

The four professionals who formed the expert panel responded to eight questions relating to the quality of the data produced by the NCHA II. The experts noted that there was no theoretical basis for creating the NCHA I and subsequently II, which could potentially lead to problems when using the instrument in a research capacity. They agreed that without a "root," or something to ground the research, it would be problematic to use the NCHA II as a research instrument. Many items from the instrument require recall from participants regarding behaviors that occurred anywhere between seven days to 12 months prior to taking the questionnaire. The experts agreed that this was also a threat to validity. Another threat to validity indicated by the experts was the high usage of yes/no questions which could cause a researcher utilizing the instrument to be "set up for failure." Having responses in a yes/no, or binary, response allows minimal variability in the items and, therefore, contributes little to the sum of all the elements (DeVellis, 2012). Further, from a psychometric perspective, the expert panel indicated that it is difficult to combine yes/no response type questions with other response options and would require revisions or recoding when wishing to conduct permissible arithmetical operations other than counting (Duncan, 1984; Thompson, 2006).

The experts indicated the NCHA II would be a good instrument to use in collaboration with other instruments. For example, one of the experts researches alcohol and substance abuse. The expert indicated he would use the instrument with another

scale, such as a sensation seeking scale or impulsivity scale, but that he would not use it as the sole instrument in a study. By combining the NCHA II with another validated scale for data collection, it would add strength to the data produced by the NCHA II. The experts agreed, therefore, that the measure could be used as bits and pieces but not as a measure alone and would use some other validated scale in addition to the NCHA II to answer research questions.

One expert indicated questionnaires, such as the NCHA II, are inherently flawed as participants typically respond in the way they think they "should" respond based on cultural norms or on socially acceptable behaviors. One way to combat a socially desirable response is to include validation items in the instrument. "Including a social desirability scale allows the investigator to assess how strongly individual items are influenced by social desirability" (DeVellis, 2012, p. 101). Missing data were also a concern as the instruction page indicated that the participants may choose not to answer any specific question or skip questions. This would result in missing data if students refused to answer some of the questions, specifically the more sensitive items such as alcohol use, drug use, or sexual health.

The ACHA indicates the questionnaire only takes approximately 30 minutes to complete (ACHA, 2013a); however, with this many items (over 300), many respondents may find it hard to complete in that amount of time. The experts agreed that the questionnaire would take more than 30 minutes to complete, indicating another problem with the instrument and leading to perhaps more missing data as completion may be low.

The question was raised regarding the types of data analyses researchers use with data produced by the NCHA II. When it was mentioned that some authors have used data analyses such as ANOVA or structural equation modeling, one expert indicated that that bothered him and said he did not know how he could use this instrument as a "tool for quality research."

A final comment mentioned by the panel, although not a threat to validity but still of importance, was regarding the potential illegal activity that the questionnaire could reveal regarding its participants. For example, if a student under the age of 21 answered "yes" regarding alcohol consumption, what would be the researcher's, and by default, the university's, responsibility regarding discovering that student and reporting him or her? Since the questionnaire is implemented anonymously (when using paper-based) or confidentially (when using web-based), there is no responsibility for the researchers. As another example, with regard to students who indicate suicidal thoughts and behavior, is it the responsibility of the researcher, and/or the university, to discover these participants and get them the assistance they would need? Would the university accept any liability regarding student behavior if the student followed through with suicidal intentions? What about any students who answer yes to domestic abuse? Is it the responsibility of the researcher and/or the university to identify these students and get them the help they need? By identifying students responding positively to some of these questions, researchers implementing the NCHA II would be breaking confidentiality and face issues related to the institutions' Institutional Review Boards. There are very few publications, however, focusing on these types of ethical issues as

self-report measures are usually straightforward and can often seem benign (Bersoff, 2009).

## Factors Impacting Data Quality

*Phase 2 – Assessment of construct validity*

In order to address score validity, exploratory factor analysis was conducted. Exploratory factor analysis was chosen over confirmatory factor analysis because the researcher only had theoretical expectations regarding the number and the nature of any constructs or factors about the measurement tool as opposed to having specific expectations regarding the number of factors and which variables would affect those factors (Thompson, 2004). The 17 variables created by combining like items were used for the factor analysis. A principal axis factoring with a promax oblique rotation and a pairwise deletion of missing values was used on the 17 variables formed from the NCHA II with the data gathered from the 2,509 participants. This analysis was chosen over principal components analysis with a varimax rotation because the researcher believed the factors produced would be correlated and would contain a shared variance over a unique variance as well as achieve a "better" estimate of the shared variance (Costello & Osborne, 2005; Meyers et al., 2013). A review of the Kaiser-Meyer Olkin measure of sampling adequacy indicated the sample was factorable (KMO = .743). Bartlett's test of sphericity yielded a statistically significant outcome of $p < .05$, indicating sufficient correlation between the dependent measures and, therefore, the appropriateness to proceed with the analysis.

The results of the factor analysis are shown in Table 3.4. When Eigenvalues of <1 were excluded, the analysis yielded a six-factor solution. Factor 1 had an Eigenvalue of 3.26 and accounted for 19.2% of the variance, and Factor 2 had an Eigenvalue of 2.13 and accounted for 12.6% of the variance. Factor 3 had an Eigenvalue of 1.30, accounting for 7.7% of the variance while Factor 4 had an Eigenvalue of 1.21 and accounted for 7.1% of the variance. Factor 5 had an Eigenvalue of 1.03 and accounted for 6.07% of the variance while Factor 6 had an Eigenvalue of 1.01, accounting for 5.95% of the variance. Together, the six factors accounted for 58.6% of the total variance. A solution is deemed acceptable if it accounts for at least 50% of the variance (Meyers et al., 2013). The results of the scree plot (see Figure 3.1) confirm the six factor solution with a visual representation of Eigenvalues.

Table 3.4

Promax Rotated Component Loadings for 17 Summated Variables (Structure Matrix)

| | Factor | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Safety | ---- | ---- | ---- | ---- | ---- | .342 |
| Personal violence | ---- | ---- | ---- | ---- | ---- | .562 |
| General health | .305 | ---- | ---- | ---- | ---- | ---- |
| Sleep | .550 | ---- | ---- | ---- | ---- | .304 |
| Academic performance | .747 | ---- | ---- | .317 | ---- | .439 |
| Illness & injury | .387 | ---- | ---- | ---- | ---- | ---- |
| Mental health | .616 | ---- | ---- | ---- | ---- | .302 |
| Weight / nutrition / exercise | ---- | ---- | ---- | ---- | ---- | ---- |
| Sexual behaviors | ---- | .304 | ---- | .479 | ---- | ---- |

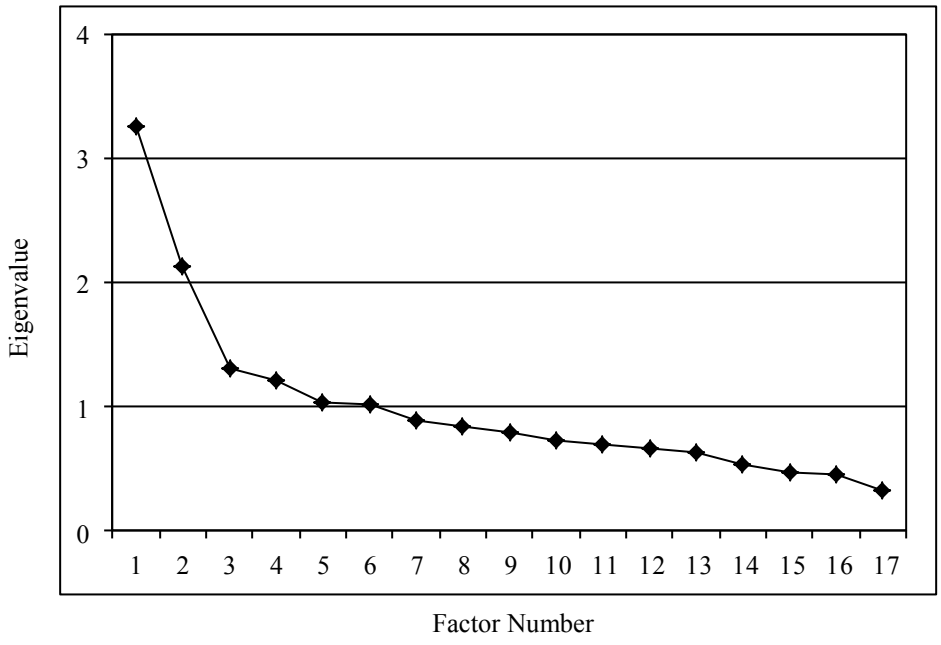
Table 3.4 Continued

| | Factor | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Harm reduction | ---- | ---- | .902 | ---- | ---- | ---- |
| Education | ---- | ---- | ---- | ---- | .629 | ---- |
| Perceptions | .302 | ---- | ---- | .311 | ---- | ---- |
| Negative experiences alcohol | ---- | .441 | ---- | .512 | ---- | .537 |
| Alcohol use | ---- | .593 | ---- | .830 | ---- | .340 |
| Other drug use | ---- | .603 | ---- | .436 | ---- | ---- |
| Tobacco use | ---- | .791 | ---- | .483 | ---- | ---- |
| Education interest | ---- | ---- | ---- | ---- | .475 | ---- |

* Only coefficients greater then a .300 are reported

Figure 3.1

Scree Plot for Visual Representation of Eigenvalues



Thompson (1991) has expressed the importance of using the structure matrix when interpreting the analysis for exploratory factor analysis; therefore, the structure matrix was examined over the pattern matrix. Gorsuch (1983) has indicated a correlation coefficient of .300 as being too small to include the item in describing factor loading. The researcher, therefore, only examined variables as "loading" onto the corresponding factor if the coefficient was at a .300 or higher. With those parameters, six variables loaded onto Factor 1. The variables of General Health (r = .305), Sleep (r = .550), Academic Performance (r = .747), Illness and Injury (r = .387), Mental Health (r = .616), and Perceptions (r = .302) all loaded onto Factor 1. The variable Academic Performance had the highest correlation at r = .747 while the Perceptions and General Health variables were lower at .302 and .305, respectively. The Sexual Behaviors (r = .304), Negative Experiences with Alcohol (r = .441), Alcohol Use (r = .593), Other Drug Use (r = .603), and Tobacco Use (r = .791) all loaded onto Factor 2. The Tobacco Use variable had the highest r value for Factor 2 (r = .791). The only variable that loaded onto Factor 3 was the Harm Reduction variable with a strong positive correlation and an r value of r = .902. Factor 4 had seven variables that loaded onto it with a coefficient of .30 or higher. The Academic Performance variable (r = .317), Sexual Behaviors (r = .479), Perceptions (r = .311), Negative Experiences with Alcohol (r = .512), Alcohol Use (r = .830), Other Drug Use (r = .436), and Tobacco Use (r = .483) all loaded onto Factor 4. The Education and Education Interest variables both loaded onto Factor 5 with r values of .629 and .475, respectively. Finally, seven variables loaded onto Factor 6 and included the variables Safety (r = .342), Personal Violence (r = .562), Sleep (r = .304),

Academic Performance (r = .439), Mental Health (r = .302), Negative Experiences with Alcohol (r = .537), and Alcohol Use (r = .340). The variable Weight/Nutrition/Exercise was the only variable that did not load (at the criterion level) onto any of the six factors.

The results of the oblique factor rotation resulted in the correlation of some of the factors. These correlations are described in Table 3.5. Most researchers would prefer to work with the oblique rotation if factors correlated in the range of .3 or higher while many would opt for an orthogonal rotation if the factors correlated in the middle teens or lower (Meyers et al., 2013). Because the correlation of factors resulted in ranges greater than .3, the results of the oblique rotation will be reported. Factors 1 and 6 had the highest correlation of .543 while Factors 2 and 4 also had a strong positive correlation of .533. Factors 4 and 6 also resulted in a strong positive correlation of .531. Factors 1 and 4 had a moderate correlation of .335. No other factors had correlations greater than r = .30.

Table 3.5

Correlations of Factors Resulting from Factor Analysis of 17 Summated Variables

| Factor | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | ---- | | | | | |
| 2 | .090 | ---- | | | | |
| 3 | .052 | -.484 | ---- | | | |
| 4 | **.335** | **.533** | -.253 | ---- | | |
| 5 | .125 | .030 | .012 | .083 | ---- | |
| 6 | **.543** | .252 | -.080 | **.531** | .140 | ---- |

Finally, a reliability assessment was conducted on the six factor solution. The results of this assessment are described in Table 3.6.

Table 3.6

Reliability Assessment for Six Factor Solution

| Factor | Cronbach's Alpha | N of items | Variables included in analysis |
|---|---|---|---|
| 1 | .297 | 6 | General Health; Sleep; Academic Performance; Illness and Injury; Mental Health; Perceptions |
| 2 | .216 | 5 | Negative Experiences with Alcohol; Sexual Behaviors; Alcohol Use; Other Drug Use; Tobacco Use |
| 3* | ---- | ---- | ---- |
| 4 | .251 | 7 | Academic Performance; Sexual Behaviors; Perceptions; Tobacco Use; Other Drug Use; Alcohol Use; Negative Experience with Alcohol |
| 5 | .447 | 2 | Education; Education Interest |
| 6 | .540 | 7 | Alcohol Use; Mental Health; Academic Performance; Sleep; Personal Violence; Safety; Negative Experiences with Alcohol |

* Only one variable loaded onto Factor 3

## Factors Beyond the Actual Instrument Items

*Phase 3 – Assessment of internal consistency*

The internal consistency of the NCHA II was estimated using Cronbach's coefficient alpha, the most widely used measure of score reliability (DeVellis, 2012). After similar items from the NCHA II were combined to form scaled variables, Cronbach's alpha was calculated using SPSS version 22.0 (SPSS, Inc. Chicago, IL). Subscales' alpha coefficients ranged from .200 (harm reduction) to .952 (interest in education). Subscales exhibiting alphas in the range of .8 and above are deemed good to

excellent, exhibiting high internal consistency, while scales exhibiting .6 to .7 are considered acceptable (George & Mallery, 2003). These ranges should be taken with a measure of caution, however, as samples with a narrow range or high number of items can inflate/deflate the value of alpha (Cortina, 1993). Alphas for the education and interest in education variables were .908 and .952, respectively. The items, therefore, combined to represent these variables "hung well" and demonstrated high internal consistency. Alphas for the perceptions, mental health, general health behaviors, sleep, and academic performance ranged from .710 to .821, demonstrating good internal consistency. Alphas for the safety, personal violence, sexual behaviors, illness, negative experiences, tobacco use, weight/nutrition/exercise, other drug use, and alcohol variables fell between .603 and .695, indicating acceptable consistency. The Cronbach's alpha coefficient of the harm reduction variable fell below the acceptable level of .6, at .200. This indicated these items do not "hang well together" and may be better served by being separated into two or more variables. Items used to create the variables, the variables, and their corresponding alphas are listed in Table 3.7. In addition to Cronbach's alphas to assess internal consistency, alphas were also run after deletion of specific items (identified as the ones lowering the level of the coefficient). The resulting Cronbach's alpha for each of the 17 variables if select items were deleted was also listed in Table 3.7

Table 3.7

Internal Consistency (Cronbach's Alpha) for New Variables Formed by Combining Like Items

| New variable created | Alpha if item deleted |
|---|---|
| Education (19 items) | |
| Received info…. | |
| Alcohol and other drug use | .904 |
| Cold/Flu/Sore throat | .907 |
| Depression/Anxiety | .902 |
| Eating disorder | .901 |
| Grief and loss | .903 |
| How to help others in distress | .903 |
| Injury and violence prevention | .902 |
| Nutrition | .903 |
| Physical activity | .903 |
| Pregnancy prevention | .902 |
| Problem use of internet/computer games | .913 |
| Relationship difficulties | .903 |
| Sexual assault/Relationship violence prevention | .903 |
| STD/I prevention | .901 |
| Sleep difficulties | .904 |
| Stress reduction | .904 |
| Suicide prevention | .902 |
| Tobacco | .902 |
| Violence prevention | .902 |
| ***Internal consistency (Cronbach alpha)*** | ***.908*** |
| Interest in education (19 items) | |
| Interested in info…. | |
| Alcohol and other drug use | .949 |
| Cold/Flu/Sore throat | .950 |
| Depression/Anxiety | .949 |
| Eating disorder | .949 |
| Grief and loss | .949 |
| How to help others in distress | .949 |
| Injury and violence prevention | .949 |
| Nutrition | .950 |
| Physical activity | .950 |
| Pregnancy prevention | .949 |
| Problem use of internet/computer games | .952 |
| Relationship difficulties | .949 |
| Sexual assault/Relationship violence prevention | .948 |
| STD/I prevention | .949 |
| Sleep difficulties | .950 |
| Stress reduction | .950 |
| Suicide prevention | .949 |
| Tobacco use | .950 |
| Violence prevention | .948 |
| ***Internal consistency (Cronbach alpha)*** | ***.952*** |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Safety (11 items) | |
| Last 12 months… | |
| Wear seatbelt in car | .698 |
| Wear helmet on bicycle | .633 |
| Wear helmet on motorcycle | .687 |
| Wear helmet inline skating | .603 |
| In physical fight | .710 |
| Physically assaulted | .699 |
| Verbally threatened | .722 |
| Feel safe… | |
| On campus-daytime | .698 |
| On campus-nighttime | .633 |
| In community surrounding school-daytime | .687 |
| In community surrounding school-nighttime | .633 |
| ***Internal consistency (Cronbach alpha)*** | ***.697*** |
| | |
| Personal violence (7 items) | |
| Sexually touched without consent | .555 |
| Sexual penetration attempted without consent | .549 |
| Sexually penetrated without consent | .573 |
| Victim of stalking | .634 |
| In emotionally abusive relationship | .633 |
| In physically abusive relationship | .601 |
| In sexually abusive relationship | .582 |
| ***Internal consistency (Cronbach alpha)*** | ***.626*** |
| | |
| Tobacco use (4 items) | |
| Last 30 days… | |
| Cigarettes | .598 |
| Tobacco from water pipe- hookah | .545 |
| Cigars, little cigars, clove cigarettes | .484 |
| Smokeless tobacco | .603 |
| ***Internal consistency (Cronbach alpha)*** | ***.624*** |
| | |
| Other drug use (17 items) | |
| Last 30 days… | |
| Marijuana | .708 |
| Cocaine | .658 |
| Methamphetamine | .680 |
| Other amphetamines | .685 |
| Sedatives | .653 |
| Hallucinogens | .665 |
| Steroids | .686 |
| Opiates | .679 |
| Inhalants | .682 |
| MDMA | .658 |
| Other club drugs | .680 |
| Other illegal drugs | .663 |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Last 12 months… | |
| Taken unprescribed antidepressants | .684 |
| Taken unprescribed erectile dysfunction drugs | .689 |
| Taken unprescribed pain killers | .670 |
| Taken unprescribed sedatives | .674 |
| Taken unprescribed stimulants | .665 |
| ***Internal consistency (Cronbach alpha)*** | ***.688*** |
| | |
| Alcohol (6 items) | |
| Last 30 days… | |
| Alcohol | .634 |
| Drive after drinking any alcohol | .703 |
| Drive after having 5 or more drinks alcohol | .709 |
| Last time partied/socialized… | |
| Number of drinks | .635 |
| Hours drinking | .608 |
| Last 2 weeks: 5 or more drinks of alcohol at a sitting | .597 |
| ***Internal consistency (Cronbach alpha)*** | ***.695*** |
| | |
| Harm reduction (35 items) | |
| During the last 12 months when partied or socialized... | |
| Alternate non-alcoholic beverages | .191 |
| Avoid drinking games | .193 |
| Choose not to drink alcohol | .195 |
| Determine not to exceed number of drinks | .192 |
| Eat before/during drinking | .191 |
| Have friend let know when had enough | .195 |
| Keep track of how many drinks | .188 |
| Pace drinks to 1 or less per hour | .190 |
| Stay with same group of friends while drinking | .190 |
| Stick with only one kind of alcohol | .192 |
| Use a designated driver | .190 |
| Last 30 days… | |
| Condom/barrier during oral sex | .075 |
| Condom/barrier during vaginal intercourse | .163 |
| Condom/barrier during anal intercourse | .422 |
| Last time you had vaginal intercourse… | |
| Use a method of birth control | .200 |
| Birth control pills | .201 |
| Birth control shots | .201 |
| Birth control implants | .200 |
| Birth control patch | .201 |
| Vaginal ring | .200 |
| Intrauterine device | .200 |
| Male condom | .202 |
| Female condom | .200 |
| Diaphragm or cervical cap | .201 |
| Contraceptive sponge | .200 |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Spermicide | .200 |
| Fertility awareness | .200 |
| Withdrawal | .199 |
| Sterilization | .200 |
| Other method | .201 |
| Ever mental health services - Counselor/Psychologist | .199 |
| Ever mental health services - Psychiatrist | .200 |
| Ever mental health services - Other medical provider | .200 |
| Ever received mental health services - Clergy | .201 |
| Ever received mental health services - University Health/Counseling | .199 |
| ***Internal consistency (Cronbach alpha)*** | ***.200*** |
| | |
| Negative experiences (9 items) | |
| Within the last 12 months, consequence of drinking… | |
| Did something later regretted | .544 |
| Forgot where/what you did | .528 |
| Got in trouble with police | .611 |
| Had sex without giving consent | .604 |
| Had sex without getting consent | .624 |
| Had unprotected sex | .558 |
| Physically injured self | .547 |
| Physically injured other | .613 |
| Seriously considered suicide | .617 |
| ***Internal consistency (Cronbach alpha)*** | ***.617*** |
| | |
| Perceptions (21 items) | |
| Last 30 days, typical student uses… | |
| Cigarettes | .700 |
| Tobacco from water pipe- hookah | .702 |
| Cigars, little cigars, clove cigarettes | .702 |
| Smokeless tobacco | .701 |
| Alcohol | .704 |
| Marijuana | .698 |
| Cocaine | .704 |
| Methamphetamine | .705 |
| Other amphetamines | .703 |
| Sedatives | .703 |
| Hallucinogens | .704 |
| Steroids | .703 |
| Opiates | .705 |
| Inhalants | .705 |
| MDMA | .704 |
| Other club drugs | .704 |
| Other illegal drugs | .703 |
| Last time partied/socialized… | |
| Number of drinks consumed by typical student | .701 |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Last 30 days… | |
| Percent students used cigarettes | .662 |
| Percent students used alcohol | .691 |
| Percent students used marijuana | .671 |
| ***Internal consistency (Cronbach alpha)*** | ***.710*** |
| | |
| Sexual behaviors (6 items) | |
| Last 12 months: | |
| Number of sexual partners | .651 |
| Used emergency contraception | .162 |
| You/partner become pregnant | .161 |
| Last 30 days sexual activity | .638 |
| Testing/vaccinations | .663 |
| Last 12 months diagnosed/treated STI | .646 |
| ***Internal consistency (Cronbach alpha)*** | ***.638*** |
| | |
| Weight/Nutrition/Exercise (9 items) | |
| Trying to do anything about weight | .629 |
| Usual number of fruits/vegetables per day | .629 |
| Past 7 days… | |
| Moderate exercise for at least 30 minutes | .560 |
| Vigorous exercise for at least 20 minutes | .509 |
| Exercise to strengthen muscles 8-1`2 repetitions | .555 |
| Last 30 days… | |
| Exercise to lose weight | .623 |
| Diet to lose weight | .635 |
| Vomit/laxatives to lose weight | .649 |
| Diet pills to lose weight | .647 |
| ***Internal consistency (Cronbach alpha)*** | ***.641*** |
| | |
| Mental health (28 items) | |
| Ever… | |
| Felt things were hopeless | .774 |
| Felt overwhelmed | .792 |
| Felt exhausted | .788 |
| Felt very lonely | .776 |
| Felt very sad | .775 |
| Felt so depressed it was difficult to function | .770 |
| Felt overwhelming anxiety | .773 |
| Felt overwhelming anger | .779 |
| Intentionally injured self | .791 |
| Seriously considered suicide | .787 |
| Attempted suicide | .794 |
| Diagnosed with depression | .791 |
| Last 12 months diagnosed/treated… | |
| Anorexia | .797 |
| Anxiety | .789 |
| ADHD | .796 |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Bipolar disorder | .796 |
| Bulimia | .796 |
| Depression | .787 |
| Insomnia | .794 |
| Other sleep disorder | .797 |
| OCD | .796 |
| Panic attacks | .792 |
| Phobia | .796 |
| Schizophrenia | .797 |
| Substance abuse/addiction | .797 |
| Other addiction | .797 |
| Other mental health condition | .791 |
| Level of stress | .787 |
| ***Internal consistency (Cronbach alpha)*** | ***.796*** |
| | |
| Sleep variable (6 items) | |
| Last 7 days… | |
| Enough sleep to feel rested | .654 |
| Problem with sleepiness | .662 |
| Awakened too early | .712 |
| Felt tired/sleepy during the day | .593 |
| Gone to bed because could not stay awake | .710 |
| Extremely hard time falling asleep | .707 |
| ***Internal consistency (Cronbach alpha)*** | ***.715*** |
| | |
| General health behaviors (21 items) | |
| Last 12 months difficult to handle… | |
| Academics | .801 |
| Career related issue | .799 |
| Death of family member/friend | .797 |
| Family problems | .798 |
| Intimate relationships | .791 |
| Other relationships | .792 |
| Finances | .805 |
| Health problem of family member/partner | .787 |
| Personal appearance | .799 |
| Personal health issue | .797 |
| Sleep difficulties | .803 |
| Other | .798 |
| Last 12 months… | |
| Dental exam/cleaning | 816 |
| Females: Routine gynecological exam | .783 |
| Males last 30 days: Testicular self-exam | .824 |
| Females last 30 days: Breast self-exam | .799 |
| Used sunscreen regularly with sun exposure | .821 |
| Vaccination/shot: Influenza | .806 |
| Vaccination/shot: Measles, Mumps, Rubella | .812 |
| Vaccination/shot: Meningitis | .807 |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Vaccination/shot: Varicella | .811 |
| ***Internal consistency (Cronbach alpha)*** | ***.810*** |
| | |
| Illness/Injury (18 items) | |
| Last 12 months diagnosed/treated… | |
| Allergies | .545 |
| Asthma | .577 |
| Back pain | .594 |
| Broken bone/sprain | .601 |
| Bronchitis | .570 |
| Diabetes | .601 |
| Ear infection | .584 |
| Endometriosis | .597 |
| High blood pressure | .602 |
| High cholesterol | .601 |
| Irritable bowel syndrome | .596 |
| Migraines | .584 |
| Mononucleosis | .601 |
| Repetitive stress injury | .601 |
| Sinus infection | 546 |
| Strep throat | .581 |
| Tuberculosis | .604 |
| Urinary tract infection | .601 |
| ***Internal consistency (Cronbach alpha)*** | ***.603*** |
| | |
| Academic performance (31 items) | |
| Last 12 months, academic performance affected… | |
| Alcohol use | .818 |
| Allergies | .817 |
| Anxiety | .806 |
| Assault (physical) | .820 |
| Assault (sexual) | .819 |
| ADHD | .815 |
| Cold/flu/sore throat | .814 |
| Concern for family member/friend | .810 |
| Chronic health problem | .817 |
| Chronic pain | .817 |
| Death of family member/friend | .819 |
| Depression | .808 |
| Discrimination | .819 |
| Drug use | .820 |
| Eating disorder/problem | .820 |
| Finances | .812 |
| Gambling | .821 |
| Homesickness | .817 |
| Injury | .819 |
| Internet use/computer games | .819 |
| Learning disability | .818 |

Table 3.7 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Participation extracurricular activities | .819 |
| Pregnancy (yours or partners) | .822 |
| Relationship difficulties | .811 |
| Roommate difficulties | .816 |
| STD/I | .820 |
| Sinus infection/ear infection/strep throat | .815 |
| Sleep difficulties | .809 |
| Stress | .801 |
| Work | .814 |
| Other | .819 |
| ***Internal consistency (Cronbach alpha)*** | ***.821*** |

## Discussion

The purpose of this paper was to revisit the psychometric properties of the ACHA NCHA II survey instrument. The first analysis was conducted by the ACHA in 2008 and resulted in an instrument the developers believed was able to generate both valid and reliable data (ACHA, 2008b). By conducting different analyses to test the instrument-related factors (theoretical foundations, level of specificity, intended use), factors impacting data quality (validity and reliability), and factors beyond the actual instrument (how questions are asked, words used, layout) of the NCHA II, the researchers achieved the purpose of the study. Most researchers using the NCHA II for their studies did not report psychometric properties of the instrument other than what the ACHA had already conducted. In fact, in a review conducted of published studies using only the NCHA II (see Chapter II), in only three of 17 articles were psychometric properties of the instrument, other than what the ACHA had already done, addressed. The researchers in these published studies utilized principal component analysis, Cronbach's alpha, and boot strapping to test psychometric properties. When combining

published studies using both the NCHA and the NCHA II, 22 of 72 published articles addressed psychometric properties by conducting their own analyses (see Chapter II). The others simply mentioned what the ACHA had done, what other studies revealed, or did not report psychometric properties at all. The more evidence that can be gathered to support the notion that an instrument is measuring what it is supposed to measure, the more confidence researchers will have in its validity (Polit & Beck, 2008).

*Measuring instrument-related factors*

In order to assess instrument-related factors such as theoretical foundation, level of specificity, and intended use, an expert panel of health and measurement professionals was gathered through a convenience sample. In this phase of testing, content validity was addressed by professionals who conduct research regularly on health behaviors. The main issue the experts had with the instrument was that there was no theoretical foundation on which to ground any research conducted utilizing the NCHA II. When utilizing instruments based on a theoretical framework, the researcher more easily bases his or her research on theory. Although construct validity analyses can be interpreted as theory (DeVellis, 2012), there was no specific theory mentioned by ACHA when developing the original NCHA. Having a theoretical framework for developing instruments can play a key role in conceptualizing measurement problems. When researchers use instruments for a study, it is difficult to have a framework for that study if there is no sound theory on which to base the instrument (DeVellis, 2012). The ACHA should consider redeveloping the tool and factor into account a theory for development. Basing a measurement tool on a sound theory would aid researchers in

basing their own research on a theoretical framework by helping guide their research and frame how they look at a topic (Neuman, 1997). Further, "relevant social science theories should always be considered before developing a scale…." (DeVellis, 2012, p. 73). The experts agreed that the instrument would not be beneficial as a research tool due to the lack of theoretical foundation. Though not necessarily an issue if used solely as a surveillance tool, researchers wishing to use a theory on which to base their research questions may struggle with using the NCHA II as a research tool. Further, theory is an important guide when wording items, determining response types, and developing time frames for recall items (DeVellis, 2012). The expert panelists did agree, however, that the NCHA II would be beneficial to use with another validated tool. For example, if a researcher on a college campus were to assess student sexual behaviors with the NCHA II and at the same time, utilize campus health center data to also assess those behaviors, then the data produced by both could be compared and studied to validate the responses from the NCHA II.

Further, concern expressed by the experts was with both the layout of the instrument and how the data resulting from the assessment are being utilized. The results of the current study indicate the data may not be appropriate for some types of research but may be adequate for policy and programming health educators and administrators may conduct on college campuses. Although like items combined to produce variables with acceptable Cronbach's alpha scores, when factor analysis was conducted, the items assessing weight/nutrition/exercise did not load onto any of the factors extracted. These questions may be better suited to another instrument.

Another limitation as listed by the experts was the high usage of yes/no responses. Because the majority of the data collected was at a nominal level, the ACHA may need to address the responses of the participants and perhaps change the responses to all interval, all ordinal, or all nominal in order to ease the analysis for researchers. Data transformation is not always the best way to handle this situation. As the results of this study indicated, many of the items that had different response rates had to be combined in order to conduct the factor analysis and the reliability testing.

The results of this phase also indicated the issue with self-reported data. When self-reports are used, common method variance can introduce a serious problem and may cause researchers to find significant outcomes in their analyses when in fact, there are none, and the results are due to the method employed (Whitman & Woszczynski, 2004). Although self-report data can be problematic as participants may respond in ways they think the researchers want them to or in ways that are socially acceptable, it is important to continue to assess health behaviors in this manner when observation and interviews are not practical and/or not available.

> According to Guo, Dixon, Whittmore, & He (2010), systematic assessment of the way in which individuals conceptualize their own health is crucial to the effective development and evaluation of interventions to promote health, because individuals' ratings of their own health have been shown to have substantial predictive validity, even when objective measures of health are controlled. (p. 661 from Keller, Ward, & Baumann, 1989)

Further, with regard to self-reporting by adolescents, researchers have demonstrated the reliability of adolescent self-report of tobacco, alcohol, and other drug use (Needle, McCubbin, Lorence, & Hochhauser, 1983; O'Malley, Bachman, & Johnston, 1983); sexual behavior (Davoli, Perucci, Sangalli, Brancato, & Dell'Uomo, 1992); suicide attempts (Velting, Rathus, & Asnis, 1998); dietary behaviors (French et al., 1998; Gilmer, Speck, Bradley, Harrell, & Belyea, 1996); and physical activity (Gilmer et al., 1996; Aaron et al., 1995; Sallis, Buono, Roby, Micale, & Nelson, 1993). Although there have been studies conducted on college student self-report data with regards to learning and the academic setting (Herzog & Bowman, 2011) and others conducted with the adolescent population (Needle et al., 1983; O'Malley et al., 1983; French et al., 1998), this research, with regards to reliability of self-report health behaviors of college students, has not been extensively studied.

*Factors impacting data quality*

Factors impacting the data quality (i.e. validity and reliability) were assessed in Phase 2 of the current analysis. In this phase, the researcher assessed construct validity by conducting a factor analysis. The results of this analysis would indicate that "items are not important in and of themselves but are important only insofar as they represent a particular part of the content domain" (Meyers et al., 2013, p. 650). The analysis resulted in the variables loading well onto six factors with the exception that the Weight/Nutrition/Exercise variable did not load (at the criterion level) onto any factors. This may indicate that the items from the instrument investigating these behaviors may be more suited on a standalone instrument as they did not relate well to the other

variables. If researchers wanted to create subscales based on the results of the analysis, the factors could be named Physical and Mental Health (Factor 1), High Risk Behaviors (Factor 2), Harm Reduction (Factor 3), High Risk Behaviors Impact on Academics (Factor 4), Knowledge (Factor 5), and Safety and Violence Prevention (Factor 6). A suggestion for improving the instrument would be to create six subscales rather than one lengthy instrument. Further, reliability analysis was run on the six factor solution. Results of this analysis indicate none of the factors fell above the acceptable score of .60.

*Factors beyond the actual instrument items*

Factors beyond the actual instrument items, such as how questions were asked, words used, and layout of the items, were assessed by creating new variables through combination of like items from the questionnaire. This assessment was conducted through Phase 3. The results of Phase 3 indicated that most of the items combine well as Cronbach alphas for all but one of the created variables fell above the acceptable level of .60. In order to combine items, however, much work had to be done with regard to coding the variables. For example, the sleep items had to be reverse- coded. For item number 42, the positive response to achieving good sleep was seven days (coded as eight) while for the other items that were measuring sleep, the positive response to getting good sleep was coded as one, the opposite of the positive response for the other sleep questions. The positive responses on item 42 were opposite the positive responses on the other items. By assessing these items in this manner, combining similar items to form variables, internal consistency of the instrument is met. To make this process simpler, however, a potential solution would be to reorder the responses so they match

the other responses for the questions that are asking for similar information. Further, by having questions with different time frames (i.e. 12 months, ever, last 30 days, etc.), some items had to be merged into subscales and then combined with other like items to create the variables. By having the time recall questions be similar, it may reduce some of these issues.

## Recommendations for the NCHA II

Based on the results of this review, instrument refinement can be undertaken in order to improve the validity and reliability of the data produced by the NCHA II. First, the length of questionnaire is burdensome. Due to the results of these analyses, there are some items that can and should be eliminated, thus shortening the time for completion.

The factor analysis results indicated there were several weak items from the instrument where the item did not load on the factor as originally theorized. If the item was less than a .30, it did not load well onto a factor (Nunnally & Bernstein, 1994). The Weight/Nutrition/Exercise variable did not load onto any of the factors extracted from the analysis. Further, the reliability analysis of the six factor solution did not result in acceptable reliability scores of the factors. All fell below the acceptable score of .6.

Of the four scales of measurement, the NCHA II uses three scales of measurement: nominal, ordinal, and interval. In order to conduct data analysis at a higher level of scale, many researchers had to interpret or change the scale of measurement. Thompson (2006), however, indicates "the only way to recover a higher level of scale is to recollect the data" (p. 20). Further, data produced at the nominal scale should not be used as an invitation to invite inappropriate arithmetic and by

assigning numbers to dichotomous variables, researchers may be premature and invite an abuse of statistics (Duncan, 1984). The instrument, therefore, is being misused. ACHA should issue a caution to researchers wishing to conduct higher level analyses on the data and researchers should also consider this limitation when identifying the type of analyses they wish to use.

## Limitations

There are several limitations that are worth noting. First, combining the like items into the 17 variables was in the opinion of the researcher. The researcher looked at the items and, based on experience in not only implementing the instrument in a population of students but also from years of experience as a health educator on a college campus, was able to identify items thought to "hang well" together. Other researchers may have identified the items and grouped them differently. Second, as funding did not allow the number of students who received an invitation to participate in 2013 to match the number in 2009 and 2011. The sample, therefore, may have resulted in a smaller sample size because the number of participants originally receiving the invitation to participate was lower. Third, by combining the data set, the researcher may have introduced bias into the analyses. One way to avoid this is to conduct validity and reliability assessments on the original data set (Orsi et al., 1999). Fourth, by using a suppression value of .300 in the factor analysis, several variables loaded onto multiple factors. By using a higher suppression value, .500 for example, these variables would not have loaded onto multiple factors. Fifth, this study included graduate/professional school students in the analyses of the data. Future replication should exclude

graduate/professional students as this is not the typical population of college students. Finally, there was missing data from the questionnaire that had to be handled. By dealing with missing data, the researcher may have also introduced bias into the analyses (Meyers et al., 2013).

## Future Directions

There are some suggestions to continue the research on psychometric properties of the NCHA II. First, consider developing subscales from the factor analysis results and all that that involves such as reliability testing, etc. Instead of using one instrument with over 300 questions, consider utilizing smaller instruments addressing the behaviors more succinctly. This would also aid in attrition and potentially solve the missing data issues due to incomplete questionnaires. Consider asking eight to ten questions per behavior rather than focusing so much on single behaviors (alcohol) and little on others (weight, nutrition, etc.). Second, examine the validity and reliability of data from each subscale. For example, Dinger (2003) studied reliability and validity of just the physical activity items of the National College Health Risk Behavior Survey conducted by the Centers for Disease Control and Prevention and found the items to have excellent test-retest reliability and validity and to be similar to other self-report physical activity questions. Third, more research should be conducted on the validity of self-report health behaviors in college students with regards to sensitive data such as alcohol, drug use, and sexual activity. There has been research conducted in this area with regard to adolescents and college students within the learning environment, but not much has been done with college students self-report of health behaviors.

## Implications for Health Education

Although, currently, the NCHA II is the best instrument to be used to determine health behaviors of college students, researchers working in college health using the NCHA II should be cautious. There are inherent problems with this instrument and with the data it produces. Although there is much need for data collection on health behaviors of college students, health educators working on college campuses should consider another tool to collect the needed information and/or the ACHA should consider an edited or newly created version of the NCHA II.

# CHAPTER IV

# EXAMINING THE NATIONAL COLLEGE HEALTH ASSESSMENT II BY INVESTIGATING FACTORS ASSOCIATED WITH WITHDRAWAL AS A CONTRACEPTIVE METHOD AMONG COLLEGE STUDENTS

## Introduction

Contraception and unintended pregnancy among sexually active college students is a concern for many. Researchers indicate 71% of students attending colleges and universities have had sexual intercourse with at least one partner in the last twelve months; 50% had at least vaginal intercourse within the last 30 days (American College Health Association [ACHA], 2013e). Many students arrive on campus having already acquired sexually active histories while in high school, and those who continue to be sexually active while in college will remain at risk for pregnancy and sexually transmitted infections (Greydanus, Rimsza, & Matytsina, 2005). As students progress through college, sexual activity rates increase, peaking at 86% by senior year (Patrick, Maggs, & Abar, 2007). To prevent unintended pregnancies, sexually active college students use many different contraceptive methods including the oral contraceptive pill, the male condom, coitus interruptus (i.e. withdrawal), the vaginal ring, intrauterine devices (IUD), hormonal shots, and others.

According to data derived from assessments conducted on college campuses nationwide, the withdrawal method is the third most common contraceptive method used by college students (27.6%) preceded only by the male condom (61.9%) and the oral contraceptive pill (60.4%) (ACHA, 2013e). In addition, withdrawal was the third most

common choice among sexually active $9^{th}$ – $12^{th}$ grade adolescents who participated in the Centers for Disease Control and Prevention Youth Risk Behavior Surveillance, behind condoms and no method, across all race groups (Cavazos-Rehg et al., 2010). One in three women in a study conducted in Australia used withdrawal as their chosen method for contraception in the last three months (Ong, Temple-Smith, Wong, McNameee, & Fairley, 2013) while other researchers found 31% of the females in a study used withdrawal as their chosen contraceptive method for at least one month during the study (Dude, Neustadt, Martins, & Gilliam, 2013). These data suggest that withdrawal is not rare when more than half of sexually active 15-24 year old, U.S. women have ever used withdrawal.

College students as a population are known for engaging in high-risk behaviors. Although students may use a contraceptive method to prevent pregnancy, they may be using an unreliable method. Methods such as withdrawal and the rhythm method are not considered reliable methods and therefore, present a high risk for pregnancy. Further, inconsistent use of any form of contraception is a reason for concern about college students. One group of researchers found 19% of students using contraception used an unreliable method such as withdrawal or the rhythm method while those choosing to use more reliable methods used them inconsistently (Kusseling, Wenger, & Shapiro, 1995).

There have been few recent reported studies conducted on withdrawal among the college population. Much of the research conducted on college students utilizing withdrawal as a contraceptive method was conducted in the early to mid-1980s. With close to one-third (27.6%) of students currently using withdrawal as a method (ACHA,

2013e), it is, therefore, important to study and identify trends in current contraceptive usage by college students and from there, examine why students choose to use withdrawal as a method.

*Reasons for choosing withdrawal*

College students use withdrawal as a contraceptive method for many reasons. Today's young adults have forgone the traditional concept of "going steady" or "wearing his class ring" and other emblems representing commitment, for more ambiguous boundaries indicating commitment, what some may term as "hooking up" (Owen, Rhoades, Stanley, & Fincham, 2010). Due to this culture shift, many students may be unprepared for the consequences of intercourse, and therefore, rely on withdrawal as a contraceptive method to prevent unintended pregnancy. Students may also use withdrawal as a backup method in case a primary method is unavailable or forgotten; however, if students use withdrawal as a backup method, unintended pregnancy may be more likely to result than if withdrawal had been used as the primary method (Mosher, Martinez, Chandra, Abma, & Wilson, 2004). Further, reasons cited as to why students are using withdrawal include religious teachings or medical objections to hormonal methods of contraception (Keller & Sack, 1982).

In addition to the reasons above, couples are attracted to withdrawal for several other reasons. Using withdrawal will produce none of the side effects such that hormonal methods may produce (Rahnama et al., 2010). Additionally, there is no cost when using this method (Rahnama et al., 2010). Many methods require visits to a healthcare provider in order to receive a prescription, resulting in a potential barrier to

contraceptive use for college students. Withdrawal does not require visits to a healthcare provider. The method is easy to learn, is user-controlled, and many who use the method rely on self-teaching in order to be successful with its use.

There is a good level of satisfaction with withdrawal as users do not have to interrupt intercourse to put on a condom or use other types of barrier methods (Ong et al., 2013). Satisfaction with use is also a reason why women choose certain contraceptive methods over others. Use of withdrawal was related to dissatisfaction with other methods in one study (Ong et al., 2013) while almost all of the females (90%) relying solely on withdrawal during another study had tried another contraceptive at some point in their life (Dude et al., 2013). In addition, females in this study used withdrawal as a method when they had forgotten to use their hormonal method, had difficulty using condoms correctly, or as an "emergency" form of contraception when sex was unanticipated and unplanned, particularly if this was their first time for intercourse (Dude et al., 2013). Withdrawal is also a method many women will continue to use. After one year of use, 46% of women will continue to use withdrawal as a contraceptive method (Trussell, 2011). In another study, females indicated a strong belief that pregnancy could not occur until they personally wanted it to, which resulted in using withdrawal or no method for contraception (O'Sullivan, Udell, Montrose, Antoniello, & Hoffman, 2010). This concept, often referred to as "illusionary control," is described as the study participant viewing his or her thoughts or beliefs as providing immunity to the negative outcomes, such as unintended pregnancy, others might experience with unprotected intercourse (O'Sullivan et al., 2010).

Negative physical issues and attitudes toward other contraceptive measures can also be a reason why some young men and women choose withdrawal as a method of contraception. Concerns about taking the oral contraceptive pill, such as nervousness, weight gain, and irregular bleeding drove some women to choose withdrawal (Rahnama et al., 2010). Further, concerns relating to the IUD including irregular bleeding, infection, and pain caused some users to choose other methods. Concerns related to condom use and injections such as worries about unwanted pregnancy and irregular bleeding also led some women to choose other methods (Rahnama et al., 2010).

*Withdrawal and other risky behaviors*

Withdrawal has been correlated with certain high risk behaviors in some studies. Adolescents using withdrawal have also been shown to be consumers of alcohol, users of drugs such as cocaine, and users of cigarettes (Cavazos-Rehg et al., 2013) while researchers have also shown withdrawalrs to be more likely to use emergency contraception (Dude et al., 2013). One group of researchers found adolescent Caucasians were more likely to utilize withdrawal as a contraceptive method (Cavazos-Rehg et al., 2013) while another group found Black adolescents use withdrawal more often (Ong et al., 2013). Further, adolescents with higher numbers of sexual partners are more likely to use withdrawal as a contraceptive method (Cavazos-Rehg et al., 2013).

Males who engaged in risk behaviors such as alcohol use, drug use, and cigarette smoking were also more likely to use withdrawal at the most recent sexual intercourse (Cavazos-Rehg et al., 2010). In a study conducted by Cavazos-Rehg and colleagues (2010), Caucasian, adolescent males were also more likely to engage in withdrawal than

males of African-American or Hispanic descent. Further, a higher number of sexual partners resulted in an increase in reliance on withdrawal in females and Caucasian females were more likely to rely on withdrawal than females in other race categories (Cavazos- Rehg et al., 2010). In another study with young people conducted by O'Sullivan and colleagues (2010), 77% of participants used contraception such as withdrawal, nothing, or estimated "safe days" for which to have unprotected sex and avoid pregnancy. Also in this study, men reported a mean of 6.61 partners while women reported a mean of 4.61 partners (O'Sullivan et al., 2010). A large number of participants in this particular study indicated using withdrawal as a contraceptive method (O'Sullivan et al., 2010).

In order to assess predictors associated with withdrawal as a contraceptive choice among college students, the National College Health Assessment II (NCHA II) instrument was utilized. The ACHA NCHA II is a questionnaire implemented on college campuses nationwide each fall and spring semester and is a nationally recognized health assessment tool initially developed in 1999 by an interdisciplinary team of college health professionals. It was created for use by health professionals and researchers working at institutions of higher education (American College Health Association [ACHA], 2004). Researchers, however, have questioned whether this tool is an adequate tool to assess health behaviors found among college students. Limitations of the instrument have been noted by many researchers who have implemented the assessment with the students on their campuses (see Chapter II) and psychometric analyses have demonstrated the limits on the instrument (see Chapter III).

## Purpose

The purpose of the current study was twofold: to examine the American College Health Association's National College Health Assessment II (NCHA II) while identifying factors associated with withdrawal as a contraceptive method by college students. Two research questions were the focus this study: (1) What behavioral and demographic characteristics are associated with withdrawal as a contraceptive method by college students and (2) Is the NCHA II an adequate tool to address health behaviors among this population?

## Methodology

Each year the ACHA NCHA II is conducted on college campuses across the nation. The ACHA NCHA II is a nationally recognized health assessment tool initially developed in 1999 (NCHA I) by an interdisciplinary team of college health professionals. It was created for use by health professionals and researchers working at institutions of higher education and covers seven content areas for health behaviors exhibited by college students: (1) health, health education, and safety; (2) alcohol, tobacco, and drugs; (3) sex behavior, perceptions and contraception; (4) weight, nutrition and exercise; (5) mental and physical health; (6) impediments to academic performance; and (7) demographics. Each institution participating in the NCHA must secure Institutional Review Board (IRB) approval and copies of the approval are kept on file with the ACHA. In addition, each institution is required to complete a questionnaire describing various characteristics of the institution. The NCHA II is administered in both paper-and web- based forms to randomly selected classrooms and individuals,

respectively. Only those institutions utilizing a random sampling technique to identify student participants or those institutions using randomly selected classes were included in this study's final data set. For the web-based administration, random student emails were provided by their institution to ACHA who would then send a link to the student requesting participation. The e-mail invitation included a unique identification number, allowing ACHA to prevent duplicate responses. For paper-based utilization, institutions randomly selected classrooms in which to administer the assessment. Participating institutions have utilized a variety of incentives in order to encourage participation. These included small incentives (such as tickets to athletic events or extra course credit) for all participants or the opportunity to be placed into a random drawing for a larger prize (such as cash). Web-based implementation was generally given over a period of two to four weeks with several reminder emails sent by ACHA. Data from the NCHA II instrument currently provide the most comprehensive secondary data set available to researchers investigating factors that influence college students' health behaviors, perceptions, and habits.

For the current study, the most recent full semester data available were utilized (i.e. data collected in fall 2012) and consisted of 28,237 respondents. The mean response rate for the paper administration was 78% while the mean response rate for the web administration was 16%. All fall 2012 institutions reported an overall mean response rate at 20% (ACHA, 2013d). These rates compare favorably to typical response rates for population health assessments (Musich, Adams, DeWolf, & Edington,

2001). The current study was reviewed and approved by the Texas A&M University Institutional Review Board.

## Measures

The researcher utilized a retrospective cross-sectional design consisting of a secondary data set collected during the fall semester of 2012 using the ACHA NCHA II instrument.

### *Demographics of participating Fall 2012 institutions*

Fifty-one post-secondary institutions representing a variety of geographic regions of the United Stated participated. Listed in Table 4.1 is a description of participating institutions in the full sample from the ACHA of the NCHA II during the fall 2012 semester.

Table 4.1

Demographics of 51 Participating Institutions, Fall 2012 (ACHA, 2013d)

| Campus Characteristic | N |
|---|---|
| Type of institution | |
| Public | 23 |
| Private | 28 |
| 2-year | 3 |
| 4-year | 48 |
| Location of campus | |
| Northeast (CT, ME, MA, NH, NJ, NY, PA, RI, VT) | 21 |
| Midwest (IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI) | 10 |
| South (AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV) | 13 |
| West (AK, AZ, CA, CO, HI, ID, MY, NV, NM, OR, UT, WA, WY) | 7 |
| Campus Size | |
| < 2,500 students | 8 |
| 2,500 – 5,000 students | 13 |
| 5,000 – 9,999 students | 11 |
| 10,000 – 19,999 students | 8 |
| 20,000 students or more | 11 |

Demographically, the institutions were predominately in the Northeast with 21 colleges from that area of the United States and 13 in the South, 10 in the Midwest, and seven in the Western US. Eight schools had less than 2,500 students, 13 had 2,500-4,999, 11 had 5,000-9,999, eight had 10,000-19,999, and 11 had student bodies of more than 20,000. Twenty-three institutions were public colleges or universities and there were 28 private schools. The majority of participating institutions were 4-year schools (n = 48) while three were 2-year schools.

## Variables and Inclusion Criteria

The variables chosen for the analyses in this study were taken from the NCHA II instrument. This survey tool is not theory-based, and therefore, the choices of predictors are limited to the variables measured in the survey. The literature, however, that assessed withdrawal in adolescents was reviewed, and variables were chosen based on the results found in the published studies of withdrawal and adolescents.

Inclusion criteria were applied to the reference group data for use in the current analyses. Only students who were ages 18-24 were included as the researcher was only interested in withdrawal in the typical college student. The 18-24 age group was selected as this is the typical age of college students (Simons et al., 2012) and was reported as having high rates of both unintended pregnancy (Brunner Huber & Ersek, 2011) and sexually transmitted diseases/infections with nearly half of new infections occurring in this population (Centers for Disease Control and Prevention [CDC], 2014). Only sexually active students using a method of contraception the last time they had

vaginal intercourse were included. Adopting these criteria resulted in a final sample size of n=11,700 (41.4% of the fall 2012 reference group sample).

The outcome variable for this study was the number of sexually active students indicating withdrawal as a method of contraception. Question number 23 on the NCHA II asks participants "Did you or your partner use a method of birth control to prevent pregnancy the last time you had vaginal intercourse?" Respondents who answered "Yes" were sent to a follow-up question: "Please indicate whether or not you or your partner used each of the following methods of birth control to prevent pregnancy the last time you had vaginal intercourse". A variety of birth control methods were listed and included birth control pills (monthly or extended cycle); birth control shots; birth control implants; birth control patch; vaginal ring; intrauterine device (IUD); male condom; female condom; diaphragm/cervical cap; contraceptive sponge; spermicide (e.g. foam, jelly, cream); fertility awareness (e.g. calendar, mucous, basal body temperature); withdrawal; sterilization (e.g. hysterectomy, tubes tied, or vasectomy); and other methods. Students could indicate more than one method but only students indicating withdrawal as one of those methods were included in the study. The prediction of withdrawal was evaluated based on relationships with the independent variables listed in Table 4.2. The item number from the questionnaire, the question asked, and the response options for each item are also listed in Table 4.2.

Table 4.2

Variables Used to Predict Withdrawal in College Students

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Demographics | | | |
| General health | 1 | How would you describe your general health? | Excellent; Very good; Good; Fair; Poor; Don't know |
| Age | 46 | How old are you? | 00 – 99 |
| Gender | 47 | What is your gender? | Male; Female; Transgender |
| Year in school | 51 | What is your year in school? | 1st year undergraduate; 2nd year undergraduate; 3rd year undergraduate; 4th year undergraduate; 5th year or more undergraduate; Graduate/ professional; Not seeking a degree; Other |
| Race | 54 | How do you usually describe yourself? (mark all that apply) | White; Black or African American; Hispanic or Latino/a; Asian or Pacific Islander; Am Indian, Alaskan Native, or Native Hawaiian; Biracial or Multiracial; Other |
| Relationship status | 56 | What is your relationship status? | Not in a relationship; In a relationship but not living together; In a relationship and living together |
| Marital status | 57 | What is your marital status? | Single; Married/partnered; Separated; Divorced; Other |
| Place of residence | 58 | Where do you currently live? | Campus residence hall; Fraternity or sorority house; Other college/university housing; Parent/guardian's home; Other off-campus housing; Other |
| GPA | 63 | What is your approximate cumulative grade point average? | A; B; C; D/F; N/A |
| Member of Fraternity / Sorority | 59 | Are you a member of a social fraternity or sorority? (e.g. National Interfraternity Conference, National Panhellenic Conference, National Pan-Hellenic Council, National Association of Latino Fraternal Organizations) | Yes; No |

Table 4.2 Continued

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Sexual Orientation | 48 | What is your sexual orientation? | Heterosexual; Gay/Lesbian; Bisexual; Unsure |
| Relationship abuse items (combine to create "relationship abuse" variable) | | | |
| Emotional abuse | 6 | Within the last 12 months, have you been in an intimate (couple/partnered) relationship that was: Emotionally abusive? (e.g. called derogatory names, yelled at, ridiculed) | Yes/No |
| Physical abuse | 6 | Within the last 12 months, have you been in an intimate (couple/partnered) relationship that was: Physically abusive? (e.g. kicked, slapped, punched) | Yes/No |
| Sexual abuse | 6 | Within the last 12 months, have you been in an intimate (couple/partnered) relationship that was: Sexually abusive? (e.g. forced to have sex when you didn't want it, forced to perform or have an unwanted sexual act performed on you) | Yes/No |
| Sexual violence items (combined to create "sexual violence" variable) | | | |
| Sexual touch | 5 | Within the last 12 months: Were you sexually touched without your consent? | Yes/No |

Table 4.2 Continued

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Sexual penetration attempt | 5 | Within the last 12 months: Was sexual penetration attempted (vaginal, anal, oral) without your consent? | Yes/No |
| Sexual penetration | 5 | Within the last 12 months: Were you sexually penetrated (vaginal, anal, oral) without your consent? | Yes/No |
| Alcohol items (combined to create "alcohol use" variable) | | | |
| Alcohol use – days | 8 | Within the last 30 days, on how many days did you use: Alcohol (beer, wine, liquor) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Alcohol use – number of drinks | 10 | The last time you "partied/socialized" how many drinks of alcohol did you have? | 00 - 99 |
| Alcohol use – number of hours | 11 | The last time you "partied/socialized" over how many hours did you drink alcohol? | 00 – 99 |
| Alcohol use – 5+ drinks | 13 | Over the last two weeks, how many times have you had five or more drinks of alcohol at a sitting? | N/A don't drink; None; 1 time; 2 times; 3 times; 4 times; 5 times; 6 times; 7 times; 8 times; 9 times; 10 or more times |
| Sexual behaviors | | | |
| Partners | 19 | Within the last 12 months, with how many partners have you had oral sex, vaginal intercourse, or anal intercourse? | 00 – 99 |
| Oral sex | 21 | Within the last 30 days, did you have: Oral sex? | Yes/No |

Table 4.2 Continued

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Vaginal sex | 21 | Within the last 30 days, did you have: Vaginal intercourse? | Yes/No |
| Anal sex | 21 | Within the last 30 days, did you have: Anal intercourse | Yes/No |
| Condom use – Oral sex | 22 | Within the last 30 days, how often did you or your partner(s) use a condom or other protective barrier (e.g. male condom, female condom, dam, glove) during: Oral sex | N/A, never did this sexual activity; Have not done this sexual activity during the last 30 days; Never; Rarely; Sometimes; Most of the time; Always |
| Condom use – Vaginal intercourse | | Within the last 30 days, how often did you or your partner(s) use a condom or other protective barrier (e.g. male condom, female condom, dam, glove) during: Vaginal intercourse | N/A, never did this sexual activity; Have not done this sexual activity during the last 30 days; Never; Rarely; Sometimes; Most of the time; Always |
| Condom use – Anal intercourse | | Within the last 30 days, how often did you or your partner(s) use a condom or other protective barrier (e.g. male condom, female condom, dam, glove) during: Anal intercourse | N/A, never did this sexual activity; Have not done this sexual activity during the last 30 days; Never; Rarely; Sometimes; Most of the time; Always |
| Emergency contraception | 24 | Within the last 12 months, have you or your partner(s) used emergency contraception ("morning after pill")? | N/A, have not had vaginal intercourse; No; Yes; Don't know |
| Pregnancy | 25 | Within the last 12 months, have you or your partner(s) become pregnant? | N/A, have not had vaginal intercourse in the last 12 months; No; Yes, unintentionally; Yes, intentionally; Don't know |

Table 4.2 Continued

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Sexually transmitted infection diagnosis (created variable by combining positive diagnoses for the following): | | | |
| Chlamydia | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Chlamydia | Yes/No |
| Genital herpes | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Genital herpes | Yes/No |
| Genital warts/Human Papilloma Virus (HPV) | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Genital warts/Human Papilloma Virus (HPV) | Yes/No |
| Gonorrhea | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Gonorrhea | Yes/No |
| Hepatitis B or C | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Hepatitis B or C | Yes/No |
| Human Immunodeficiency Virus (HIV) | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Human Immunodeficiency Virus (HIV) | Yes/No |

Table 4.2 Continued

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Pelvic Inflammatory Disease (PID) | 41 | Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? Pelvic Inflammatory Disease (PID) | Yes/No |
| Tobacco and other drug use (combined to form "drug use" variable) | | | |
| Cigarettes | 8 | Within the last 30 days, on how many days did you use: Cigarettes | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Tobacco from a water pipe (hookah) | 8 | Within the last 30 days, on how many days did you use: Tobacco from a water pipe (hookah) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Cigars | 8 | Within the last 30 days, on how many days did you use: Cigars, little cigars, clove cigarettes | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Smokeless tobacco | 8 | Within the last 30 days, on how many days did you use: Smokeless tobacco | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Marijuana | 8 | Within the last 30 days, on how many days did you use: Marijuana (pot, week, hashish, hash oil) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Cocaine | 8 | Within the last 30 days, on how many days did you use: Cocaine (crack, rock, freebase) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Meth-amphetamine | 8 | Within the last 30 days, on how many days did you use: Methamphetamine (crystal meth, ice, crank) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |

Table 4.2 Continued

| Variable | Question number | Question on NCHA II | Response Options |
|---|---|---|---|
| Other amphetamine | 8 | Within the last 30 days, on how many days did you use: Other amphetamines (diet pills, bennies( | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Sedatives | 8 | Within the last 30 days, on how many days did you use: Sedatives (downers, ludes) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Hallucinogen | 8 | Within the last 30 days, on how many days did you use: Hallucinogens (LSD, PCP) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Anabolic steroids | 8 | Within the last 30 days, on how many days did you use: Anabolic steroids (Testosterone) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Opiates | 8 | Within the last 30 days, on how many days did you use: Opiates (heroin, smack) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Inhalants | 8 | Within the last 30 days, on how many days did you use: Inhalants (glue, solvents, gas) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| MDMA | 8 | Within the last 30 days, on how many days did you use: MDMA (Ecstasy) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Other club drugs | 8 | Within the last 30 days, on how many days did you use: Other club drugs (GHB, Ketamine, Rohypnol) | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |
| Other illegal drugs | 8 | Within the last 30 days, on how many days did you use: Other illegal drugs | Never used; Have used, but not in the last 30 days; 1-2 days; 3-5 days; 6-9 days; 10-19 days; 20-29 days; Used daily |

## Analytical Processes

A series of logistic regressions were conducted to address the question of whether certain demographic and health behaviors were predictors of withdrawal in college students as well as the probability of withdrawal occurring in a given population. Logistic regression was chosen as the method of analysis because the dependent variables resulted in a dichotomous response (Kleinbaum & Klein, 2010). The predictors in the model were age (18-24), gender, year in school, sexual orientation, approximate GPA, member in fraternity/sorority, current residence (campus residence hall, fraternity/sorority house, other college/university housing, parent/guardian's home, other off-campus housing, other), race, relationship status, marital status, general health, alcohol use, sexual history, current sexual behaviors, tobacco/drug use, relationship abuse, and sexual violence. The null hypothesis was that the odds ratio for each of the independent variables is equal to one for this set of predictors.

Prior to the regression analysis, however, new variables were created by combining like items from the survey instrument. The variables were created to assess the internal consistency of the NCHA II. Internal consistency is based on the assumption that items measuring the same construct should be positively correlated (Kimberlin & Winterstein, 2004). Once new variables were formed, a cross-sectional analysis of students using withdrawal and sociodemographic characteristics was performed in order to determine demographic relationships of withdrawal. All statistical analyses were performed using SPSS version 22.0 (SPSS, Inc. Chicago, IL). A significance level for all analyses was defined as $p < .05$.

## Missing Data

Given only the ACHA has conducted validity and reliability testing on the NCHA II (psychometric properties were, however, assessed in Chapter III of this dissertation), it was important to be as conservative as possible in identifying the critical factors. If missing data represented less than 10% of the total cases, the researchers chose to use the SPSS default of listwise deletion. If missing data were greater than 10%, pairwise deletion was utilized. Conducting a missing data analysis revealed that only one variable had missing data percentage over 5% of the total cases, but since it was marginal, and the only one, the researcher chose to use the SPSS default of listwise deletion. For a further description of the missing data, see Table 4.3.

Table 4.3

Missing Data Analysis with all Variables

| Variable | Missing n value | Total cases | % missing of total |
|---|---|---|---|
| Withdrawal | | | |
| General health | 155 | 11,545 | 1.3% |
| Age | 0 | 11,700 | 0.0% |
| Gender | 66 | 11,634 | 0.6% |
| Year in school | 147 | 11,553 | 1.3% |
| Race: White | 0 | 11,700 | 0.0% |
| Black | 0 | 11,700 | 0.0% |
| Hispanic | 0 | 11,700 | 0.0% |
| Asian | 0 | 11,700 | 0.0% |
| Alaskan | 0 | 11,700 | 0.0% |
| Biracial | 0 | 11,700 | 0.0% |
| Other | 0 | 11,700 | 0.0% |
| Relationship status | 106 | 11,594 | 0.9% |
| Sexual orientation | 88 | 11,612 | 0.8% |
| Member of fraternity/sorority | 190 | 11,510 | 1.6% |

Table 4.3 Continued

| Variable | Missing n value | Total cases | % missing of total |
|---|---|---|---|
| Approximate GPA | 127 | 11,573 | 1.2% |
| Marital status | 133 | 11,567 | 1.1% |
| Current residence | 108 | 11,592 | 0.9% |
| Sexual violence | 115 | 11,585 | 1.0% |
| Sexual history | 276 | 11,424 | 2.4% |
| Relationship abuse | 143 | 11,557 | 1.2% |
| Sexual behaviors | 632 | 11,068 | 5.4% |
| Alcohol | 199 | 11,501 | 1.7% |
| Tobacco Other drug use | 529 | 11,171 | 4.5% |

## Results

The majority of respondents in the sample indicated their general health as good to excellent with 91.5% of students indicating as such (good = 30.9%; very good = 46.0%; excellent = 14.6%). Respondents participating in the aggregate sample (n = 11,700) were a mean age of 20.19 (SD = 1.669) years with 19% of the sample being age 18 (n = 2,226), 19.2% being age 19 (n = 2,241), 21.2% being age 20 (n = 2,477), 19.8% being age 21 (n = 2,321), 10.3% being age 22 (n = 1,203), 6.1% being age 23 (n = 711), and 4.5% being age 24 (n = 521) . Females made up 69.5% (n = 8,137) of the sample, males constituted 29.8% (n = 3,484), and 0.1% of the sample identified as transgender (n = 13). Participants were closely distributed across academic years with 22.1% (n = 2,590) first-year undergraduates, 21.0% (n = 2,454) second-year undergraduates, 23.4% (n = 2,742) third-year undergraduates, 20.2% (n = 2,368) fourth-year undergraduates, 5.8% (n = 674) in their fifth year or more of undergraduate, and 6.1% in a graduate/professional school program (n = 690), not seeking a degree (n = 7), or responding as other (n = 48). The vast majority of the sample were Caucasian (79.3%; n

= 9,277) followed by Hispanic or Latino/a (10.7%; n = 1,527), Asian or Pacific Islander (7.2%; n = 846), Black/non-Hispanic (5.1%; n = 601), and American Indian, Alaskan Native, Native Hawaiian (1.7%; n = 196). Four percent of respondents indicated biracial or multiracial (3.9%; n = 460). The full demographic description of the sample is shown in Table 4.4.

Table 4.4

Demographics of Sample

| Demographic | Sample n = 11,700 | Percentage |
|---|---|---|
| General health | | |
| Excellent | 1,713 | 14.6% |
| Very good | 5,380 | 46.0% |
| Good | 3,621 | 30.9% |
| Fair | 708 | 6.1% |
| Poor | 101 | 0.9% |
| Don't know | 22 | 0.2% |
| Age | | |
| 18 | 2,226 | 19.0% |
| 19 | 2,241 | 19.2% |
| 20 | 2,477 | 21.2% |
| 21 | 2,321 | 19.8% |
| 22 | 1,203 | 10.3% |
| 23 | 711 | 6.1% |
| 24 | 521 | 4.5% |
| Gender | | |
| Female | 8,137 | 69.5% |
| Male | 3,484 | 29.8% |
| Transgender | 13 | 0.1% |
| Year in school | | |
| 1st year undergraduate | 2,590 | 22.1% |
| 2nd year undergraduate | 2,454 | 21.0% |
| 3rd year undergraduate | 2,742 | 23.4% |

Table 4.4 Continued

| Demographic | Sample n = 11,700 | Percentage |
|---|---|---|
| Year in school | | |
| 4th year undergraduate | 2,368 | 20.2% |
| 5th year undergraduate or more | 674 | 5.8% |
| Graduate/professional | 670 | 5.7% |
| Not seeking a degree | 7 | 0.1% |
| Other | 48 | 0.4% |
| Race/ethnicity | | |
| White | 9,277 | 79.3% |
| Black or African American | 601 | 5.1% |
| Hispanic or Latino/a | 1,257 | 10.7% |
| Asian or Pacific Islander | 846 | 7.2% |
| American Indian, Alaskan Native, Native Hawaiian | 196 | 1.7% |
| Biracial or Multiracial | 460 | 3.9% |
| Other | 289 | 2.5% |
| Current residence | | |
| Campus residence hall | 4,879 | 41.7% |
| Fraternity/Sorority house | 166 | 1.4% |
| Other campus housing | 665 | 5.7% |
| Parent/Guardian's home | 1,636 | 14.0% |
| Other off-campus housing | 3,927 | 33.6% |
| Other | 319 | 2.8% |
| Relationship status | | |
| Not in a relationship | 4,895 | 41.8% |
| In relationship, not living together | 5,522 | 47.2% |
| In relationship, living together | 1,177 | 10.1% |
| Marital status | | |
| Single | 10,933 | 93.4% |
| Married | 413 | 3.5% |
| Separated | 6 | 0.1% |
| Divorced | 20 | 0.2% |
| Other | 195 | 1.7% |
| Sexual orientation | | |
| Heterosexual | 10,936 | 93.5% |
| Gay/Lesbian | 48 | 0.4% |
| Bisexual | 463 | 4.0% |
| Don't know | 165 | 1.4% |
| Member of fraternity/sorority | | |
| Yes | 9,729 | 83.2% |

Table 4.4 Continued

| Demographic | Sample n = 11,700 | Percentage |
|---|---|---|
| Member of fraternity/sorority | | |
| No | 1,781 | 15.2% |
| Approximate GPA | | |
| A | 4,119 | 35.2% |
| B | 5,837 | 49.9% |
| C | 1,152 | 9.8% |
| D/F | 58 | 0.5% |
| Don't know | 407 | 3.5% |

The six variables created by combining items with similar content were alcohol use, sexual behaviors, sexual history, sexual abuse, relationship abuse, and tobacco/drug use. The internal consistency of the NCHA II was estimated using Cronbach's coefficient alpha, the most widely used measure of reliability (DeVellis, 2012). After the items from the NCHA II were combined to form variables, Cronbach's alpha was calculated using SPSS version 22.0 (SPSS, Inc. Chicago, IL). Reliability ranged from .483 (Sexual History) to .787 (Alcohol Use). Scales exhibiting alphas in the range of .8 and above are deemed good to excellent and are thereby found to "hang together," exhibiting high internal consistency, while scales exhibiting .6 to .7 are deemed acceptable (George & Mallery, 2003). These ranges, however, should be taken with a measure of caution as samples with a narrow range or high number of items can inflate/deflate the value of alpha (Cortina, 1993). Alphas for the alcohol use, tobacco/drug use, and sexual violence had good to excellent alpha scores at .787, .746, and .736, respectively; therefore, the items combined to represent these variables "hung well" together and demonstrated good internal consistency. The alpha score for the

sexual behaviors variable was .633, indicating acceptable consistency. The alpha scores for the sexual history (.483) and the relationship abuse (.523) variables fell below the acceptable coefficient. Items used to create the variables, the variables, and their corresponding alphas for each are listed in Table 4.5. In addition to Cronbach's alphas to assess internal consistency, alphas were also run if the items were deleted. The resulting Cronbach's alpha for each of the six variables if the items were deleted are also listed in Table 4.5. The items combined to form the six variables used in the logistic regression model combined well and resulted in acceptable Cronbach's alphas. By exploring the questionnaire in this way, it demonstrates good internal consistency of the items on the NCHA II instrument. The results of this analysis indicate the items on the NCHA II have good internal consistency.

Table 4.5

Variables Created and Associated Cronbach's Alpha

| New variable created | Alpha if item deleted |
|---|---|
| Alcohol use | |
| Within the last 30 days, on how many days did you use: Alcohol (beer, wine, liquor) | .748 |
| The last time you "partied/socialized" how many drinks of alcohol did you have? | .727 |
| The last time you "partied/socialized" over how many hours did you drink alcohol? | .736 |
| Over the last two weeks, how many times have you had five or more drinks of alcohol at a sitting? | .723 |
| ***Internal consistency (Cronbach's alpha)*** | ***.787*** |
| Sexual history | |
| Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? | |
| Chlamydia | .462 |
| Genital herpes | .434 |

Table 4.5 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Genital warts/Human Papilloma Virus (HPV) | .489 |
| Gonorrhea | .395 |
| Hepatitis B or C | .419 |
| Human Immunodeficiency Virus (HIV) | .459 |
| Pelvic Inflammatory Disease (PID) | .463 |
| ***Internal consistency (Cronbach's alpha)*** | ***.483*** |
| Tobacco/drug use | |
| Within the last 30 days, on how many days did you use: | |
| Cigarettes | .728 |
| Tobacco from a water pipe (hookah) | .724 |
| Cigars, little cigars, clove cigarettes | .721 |
| Smokeless tobacco | .738 |
| Marijuana (pot, week, hashish, hash oil) | .727 |
| Cocaine (crack, rock, freebase) | .730 |
| Methamphetamine (crystal meth, ice, crank) | .747 |
| Other amphetamines (diet pills, bennies) | .736 |
| Sedatives (downers, ludes) | .732 |
| Hallucinogens (LSD, PCP) | .727 |
| Anabolic steroids (Testosterone) | .743 |
| Opiates (heroin, smack) | .740 |
| Inhalants (glue, solvents, gas) | .741 |
| MDMA (Ecstasy) | .726 |
| Other club drugs (GHB, Ketamine, Rohypnol) | .739 |
| Other illegal drugs | .731 |
| ***Internal consistency (Cronbach's alpha)*** | ***.746*** |
| Relationship abuse | |
| Within the last 12 months, have you been in an intimate (couple/partnered) relationship that was: | |
| Emotionally abusive? (e.g. called derogatory names, yelled at, ridiculed) | .462 |
| Physically abusive? (e.g. kicked, slapped, punched) | .348 |
| Sexually abusive? (e.g. forced to have sex when you didn't want it, forced to perform or have an unwanted sexual act performed on you) | .475 |
| ***Internal consistency (Cronbach's alpha)*** | ***.523*** |
| Sexual violence | |
| Within the last 12 months: | |
| Were you sexually touched without your consent? | .808 |
| Was sexual penetration attempted (vaginal, anal, oral) without your consent? | .529 |
| Were you sexually penetrated (vaginal, anal, oral) without your consent? | .657 |
| ***Internal consistency (Cronbach's alpha)*** | ***.736*** |

Table 4.5 Continued

| New variable created | Alpha if item deleted |
|---|---|
| Sexual behaviors | |
| Within the last 12 months: | |
| With how many partners have you had oral sex, vaginal intercourse, or anal intercourse? | .638 |
| Have you or your partner(s) used emergency contraception ("morning after pill")? | .641 |
| Sexual behaviors | |
| Have you or your partner(s) become pregnant? | .614 |
| Within the last 30 days: | |
| Did you have: Oral sex? | .588 |
| Did you have: Vaginal intercourse? | .622 |
| Did you have: Anal intercourse | .546 |
| How often did you or your partner(s) use a condom or other protective barrier (e.g. male condom, female condom, dam, glove) during: Oral sex | .589 |
| How often did you or your partner(s) use a condom or other protective barrier (e.g. male condom, female condom, dam, glove) during: Vaginal intercourse | .622 |
| How often did you or your partner(s) use a condom or other protective barrier (e.g. male condom, female condom, dam, glove) during: Anal intercourse | .561 |
| ***Internal consistency (Cronbach's alpha)*** | ***.633*** |

*Cross-sectional analysis*

The cross-sectional analysis indicated the students using withdrawal as a contraceptive method exhibited an approximately equal distribution of 18 (n = 741), 19 (n = 703), 20 (n = 759), and 21 (n = 732) years of age. Students older than 21 used withdrawal approximately half or less often as those who were younger. Female (n = 2,264) students were more likely than male (n = 1,000) students to use withdrawal as a contraceptive method. First year undergraduates (n = 852), second year undergraduates (n = 739), third year undergraduates (n = 830), and fourth year undergraduates (n = 759) were also more likely to use withdrawal than fifth year undergraduates,

graduate/professional students, or those not seeking a degree. This would correspond with the higher number of 18-21 year old students using this method for contraception. Of the students reporting they were White, 32.0% (n = 2,901) indicated they used withdrawal as a contraceptive method while 36.1% (n = 211) of Black or African American students used withdrawal. Thirty-two percent (n = 382) of students of Hispanic/Latino/a descent indicated withdrawal as a contraceptive method while 32.4% (n = 263) of Asian/Pacific Islander students used the method. Of the students indicating American Indian/Alaskan Native/Native Hawaiian, 34.2% (n = 64) indicated withdrawal and 38.4% (n = 164) of those students indicating bi- or multi-racial used withdrawal. A complete analysis of student demographic characteristics and withdrawal is described in Table 4.6.

Table 4.6

Cross-Sectional Analysis of Students Using Withdrawal as a Method of Contraception and Demographics

| Demographic | Yes to withdrawal | No to withdrawal | Percentage of yes responses |
|---|---|---|---|
| General health | | | |
| Excellent | 510 | 1,151 | 30.7% |
| Very good | 1,658 | 3,583 | 31.6% |
| Good | 1,173 | 2,355 | 33.2% |
| Fair | 226 | 461 | 32.9% |
| Poor | 26 | 71 | 26.8% |
| Don't know | 7 | 15 | 31.8% |
| Age | | | |
| 18 | 741 | 1,418 | 34.3% |
| 19 | 703 | 1,477 | 32.2% |
| 20 | 759 | 1,655 | 31.4% |
| 21 | 732 | 1,532 | 32.3% |

Table 4.6 Continued

| Demographic | Yes to withdrawal | No to withdrawal | Percentage of yes responses |
|---|---|---|---|
| 22 | 358 | 803 | 30.8% |
| 23 | 203 | 482 | 29.6% |
| 24 | 149 | 357 | 29.4% |
| Gender | | | |
| Male | 1,000 | 2,353 | 29.8% |
| Female | 2,624 | 5,319 | 33.0% |
| Year in school | | | |
| 1st year undergraduate | 852 | 1,659 | 33.9% |
| 2nd year undergraduate | 739 | 1,645 | 31.0% |
| 3rd year undergraduate | 830 | 1,844 | 31.0% |
| 4th year undergraduate | 759 | 1,544 | 33.0% |
| 5th year undergraduate or more | 219 | 434 | 33.5% |
| Graduate/professional | 195 | 456 | 30.0% |
| Not seeking a degree | 2 | 5 | 28.6% |
| Other | 9 | 39 | 18.8% |
| Race/ethnicity | | | |
| White | 2,901 | 6,122 | 32.0% |
| Black or African American | 211 | 373 | 36.1% |
| Hispanic or Latino/a | 382 | 838 | 31.3% |
| Asian or Pacific Islander | 263 | 568 | 31.6% |
| American Indian, Alaskan Native, Native Hawaiian | 64 | 130 | 33.0% |
| Biracial or Multiracial | 164 | 288 | 36.3% |
| Other | 87 | 195 | 30.9% |
| Relationship status | | | |
| Not in a relationship | 1,440 | 3,314 | 30.3% |
| In relationship, not living together | 1,879 | 3,498 | 34.9% |
| In relationship, living together | 302 | 839 | 26.5% |
| Marital status | | | |
| Single | 3,440 | 7,198 | 32.3% |
| Married | 94 | 303 | 23.7% |
| Separated | 2 | 4 | 33.3% |
| Divorced | 7 | 12 | 36.8% |
| Other | 74 | 114 | 39.4% |
| Current residence | | | |
| Campus residence hall | 1,475 | 3,277 | 31.0% |
| Fraternity/Sorority house | 62 | 99 | 38.5% |
| Other campus housing | 215 | 437 | 33.0% |
| Parent/Guardian home | 550 | 1,036 | 34.7% |

Table 4.6 Continued

| Demographic | Yes to withdrawal | No to withdrawal | Percentage of yes responses |
|---|---|---|---|
| Other off-campus housing | 1,229 | 2,584 | 32.2% |
| Other | 89 | 216 | 29.2% |
| Sexual Orientation | | | |
| Heterosexual | 3,454 | 7,178 | 32.5% |
| Sexual Orientation | | | |
| Gay/Lesbian | 5 | 41 | 10.9% |
| Bisexual | 132 | 320 | 29.2% |
| Unsure | 32 | 126 | 20.3% |
| Approximate GPA | | | |
| A | 1,274 | 2,757 | 31.6% |
| B | 1,851 | 3,820 | 32.6% |
| C | 366 | 741 | 33.1% |
| D/F | 20 | 36 | 35.7% |
| N/A | 102 | 290 | 26.0% |
| Member of fraternity/sorority | | | |
| Yes | 597 | 1,138 | 34.4% |
| No | 3,000 | 6,457 | 31.7% |

*Logistic regression model*

A logistic regression analysis was conducted to predict withdrawal as a contraceptive method by college students using age, gender, general health status, year in school, race, relationship status, marital status, place of residence, GPA, membership in a fraternity or sorority, sexual orientation, alcohol use, relationship abuse, sexual abuse, sexual history, sexual behaviors, and tobacco/drug use as predictors. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between users and nonusers of withdrawal as a contraceptive method (chi-square = 144.87; $p < .000$ with df = 23).

The dependent variable, measuring the use of withdrawal as a contraceptive method by college students, had responses of yes and no, thus satisfying the assumption for logistic regression being used for dichotomous dependent variables. When withdrawal was entered into the binary logistic regression model, the model was significant because the p value of the omnibus test of model coefficient fell below the alpha level of $p < .05$. The classification table indicated 67.8% of the cases were correctly predicted. Results of the classification table are listed in Table 4.7.

Table 4.7

Logistic Regression Classification Table

| Observed | | Predicted | | |
|---|---|---|---|---|
| | | Method birth control last time vaginal intercourse: Withdrawal | | Percentage Correct |
| | | No | Yes | |
| Step 0: Method of birth control last time vaginal intercourse: Withdrawal | No | 6,376 | 0 | 100.0 |
| | Yes | 3,029 | 0 | .0 |
| Overall percentage | | | | 67.8 |

Results of the Hosmer Lemeshow test indicate a non-significant result. Researchers are seeking a nonsignificant *p* value for this test so as to not reject the null model that there is no difference between the observed and predicted model, thus implying the "independent variables will accurately predict the actual probabilities" (Meyers et al., 2013, p. 543). Prediction success overall was 67.8% (100.0% for no and

0.0% for yes). The significance values demonstrate that only some of the variables in the equation chart, age (p = .001); gender (p = .009); sexual orientation (p < .001); Black/non-Hispanic (p = .037); current residence (p = .004); alcohol use (p < .001); relationship abuse (p = .005); and sexual behaviors (p = .000), made a significant contribution to prediction. The other variables were not significant predictors of withdrawal. The use of withdrawal as a contraceptive method can be successfully predicted by these variables. Odds ratios include age (OR = .919; CI = .873-.967), gender (OR = .873; CI = .789-.967), sexual orientation (OR = .845; CI = .772-.926), Black/non-Hispanic (OR = 1.276; CI =1.015-1.606), current residence (OR = 1.044; CI = 1.014-1.075), relationship abuse (OR = 1.14; CI = 1.041-1.257), alcohol use (OR = 1.004; CI = 1.002-1.006), and sexual behaviors (OR = 1.002; CI = 1.001-1.002). Further, by using this model, one can predict into which group of withdrawal users fall and this can aid health educators when educating students about contraceptive use. The variables in the equation as well as their logistic coefficient, p value, odds ratio, and confidence intervals are listed in Table 4.8.

Table 4.8

Variables in the Regression Equation

| Variable | Logistic Coefficient | *p* | Odds ratio | Confidence interval | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| General health | .008 | .784 | 1.008 | .955 | 1.063 |
| Age | **-.085** | **.001** | **.919** | **.873** | **.967** |
| Gender* | **-.135** | **.009** | **.874** | **.789** | **.967** |
| Sexual orientation** | **-.168** | **.000** | **.846** | **.772** | **.926** |

Table 4.8 Continued

| Variable | Logistic Coefficient | *p* | Odds ratio | Confidence interval | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Year in school | .017 | .557 | 1.017 | .961 | 1.076 |
| Race/ethnicity | | | | | |
| White/non-Hispanic | .038 | .643 | 1.039 | .884 | 1.222 |
| Black/ non-Hispanic | **.244** | **.037** | **1.276** | **1.015** | **1.606** |
| Hispanic or Latino/a | -.001 | .990 | .999 | .843 | 1.184 |
| Asian/Pacific Islander | -.030 | .770 | .971 | .795 | 1.185 |
| American Indian, Alaskan Native, or Native Hawaiian | -.069 | .686 | .933 | .668 | 1.304 |
| Biracial/multiracial | .179 | .117 | 1.196 | .957 | 1.495 |
| Other | .040 | .788 | 1.041 | .779 | 1.390 |
| Relationship status | .045 | .226 | 1.046 | .972 | 1.126 |
| Marital status | .050 | .217 | 1.052 | .971 | 1.139 |
| Current residence | **.043** | **.004** | **1.044** | **1.014** | **1.075** |
| Member of fraternity/sorority | .030 | .627 | 1.031 | .913 | 1.164 |
| GPA | -.034 | .197 | .967 | .918 | 1.018 |
| Sexual violence | .069 | .122 | 1.071 | .982 | 1.169 |
| Alcohol use | **.004** | **.000** | **1.004** | **1.002** | **1.006** |
| Relationship abuse | **.134** | **.005** | **1.144** | **1.041** | **1.257** |
| Sexual history | .150 | .060 | 1.161 | .994 | 1.357 |
| Tobacco/drug use | .005 | .259 | 1.005 | .996 | 1.013 |
| Sexual behaviors | **.002** | **.000** | **1.002** | **1.001** | **1.002** |

* Gender was coded as Male (1); Female (2); and Transgender (3)
** Sexual Orientation was coded as Heterosexual (1); Gay/Lesbian (2); Bisexual (3); Unsure (4)

The results of this model indicate that the variables age, gender, sexual orientation, Black/non-Hispanic, current residence, alcohol use, relationship abuse, and sexual behaviors predict that those students who fall into these categories/groups also engage in withdrawal as a contraceptive method.

The strongest predictors of withdrawal were being Black, non-Hispanic and having been in abusive relationships. Those students who were Black, non-Hispanic

were 1.3 times more likely to use withdrawal than those of other race/ethnicities. Further, those participants indicating some form of abusive relationship were 1.1 times more likely to use withdrawal than those students indicating they were not in abusive relationships. Taking the analysis further to investigate the type of abusive relationships more likely to result in withdrawal as a contraceptive choice, those who were in emotionally and sexually abusive relationships were more likely to use the method than those who had been in physically abusive relationships. A further analysis of the significant predictors from the six created variables is listed in Table 4.9.

Table 4.9

Further Analysis of Significant Predictors of Created Variables

| Variable | Logistic Coefficient | p | Odds ratio | Confidence interval | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Alcohol use | | | | | |
| Alcohol use – days | .006 | .701 | 1.006 | .975 | 1.038 |
| Alcohol use – number of drinks | .002 | .055 | 1.002 | 1.000 | 1.005 |
| Alcohol use – number of hours | -.004 | .602 | .996 | .982 | 1.010 |
| Alcohol use – 5+ drinks | .020 | .069 | 1.020 | .998 | 1.041 |
| Relationship abuse | | | | | |
| Emotional abuse | .341 | **.000** | 1.406 | 1.231 | 1.607 |
| Physical abuse | -.237 | .093 | .789 | .599 | 1.041 |
| Sexual abuse | .209 | .132 | 1.232 | .939 | 1.616 |
| Sexual behaviors | | | | | |
| Partners | .028 | **.001** | 1.028 | 1.012 | 1.045 |
| Oral sex | .002 | .534 | 1.002 | .996 | 1.008 |
| Vaginal sex | .008 | .114 | 1.008 | .998 | 1.018 |
| Anal sex | .004 | **.005** | 1.004 | 1.001 | 1.007 |
| Condom use – Oral sex | .007 | **.026** | 1.007 | 1.001 | 1.013 |

Table 4.9 Continued

| Variable | Logistic Coefficient | *p* | Odds ratio | Confidence interval | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Condom use – Vaginal intercourse | .000 | .942 | 1.000 | .992 | 1.009 |
| Condom use – Anal intercourse | -.003 | **.033** | .997 | .995 | 1.000 |
| Emergency contraception | .009 | .127 | 1.009 | .997 | 1.021 |
| Pregnancy | -.001 | .912 | .999 | .988 | 1.011 |

Students who are younger, female, and heterosexual are more likely to use withdrawal. Students who are Black/non-Hispanic, live in campus residence halls, been in emotionally abusive relationships, consume alcohol, have multiple sex partners, engage in anal sex, and use condoms for oral and anal sex are also more likely to use withdrawal for contraception.

## Discussion

The purpose of the current study was to identify factors associated with withdrawal as a contraceptive method in college students while simultaneously investigating the psychometric characteristics of the ACHA NCHA II. Two research questions were the focus this study: (1) What behavioral and demographic characteristics are associated with withdrawal as a contraceptive method in college students and (2) Is the NCHA an adequate tool to address this and other issues regarding the health of college students? From the results of the study, students who used withdrawal as a contraceptive method were more likely to be young, heterosexual, Black/non-Hispanic, live on campus in campus residence halls, been in emotionally abusive relationships,

consume alcohol, have multiple sex partners, engage in anal sex, and use condoms for oral and anal sex. These results support some of the research that has been conducted with regard to withdrawal as a contraceptive method. For example, Ong et al. (2013) found that Black adolescents were more likely to use withdrawal than other populations while Cavazos-Rehg and colleagues (2013) found those adolescents with higher numbers of sexual partners were more likely to use this method for contraception. The results of the current study support the findings from these previous studies.

Students who had been in emotionally abusive relationships were 1.4 times more likely to use withdrawal than students who had not been in that type of relationship. This may warrant further study as students in relationships that are emotionally abusive may be afraid to use another method of contraception. A secondary analysis of results from the Contraceptive CHOICE Project in St. Louis, Missouri, indicated that those women with a history of abuse discontinued their chosen contraceptive methods at a faster rate than those without abuse (Allsworth, Secura, Zhao, Madden, & Peipert, 2013) while another study also found a positive relationship between women in abusive relationships and odds of not using, changing, or using emergency contraception (Fantasia, Sutherland, Fontenot, & Lee-St. John, 2012). Neither study, however, involved an investigation of college students.

Students who lived on campus were more likely to use withdrawal than those who lived off campus. This may be related to the number of younger students engaging in withdrawal. Younger students may choose to live on campus rather than off campus.

Withdrawal as a contraceptive should not be considered "rare" and should be listed as a common method chosen by college students. Health educators and practitioners should educate college students on the use, risks, and benefits of using withdrawal as a method of contraception. According to the current study, females are more likely to use this method of contraception than males. Many females learn about withdrawal from peers, parents, and the media who are often misinformed regarding the basic use and efficacy of withdrawal as a contraceptive method and communicate that misinformation to young women (Dude et al., 2013). It is imperative, therefore, for health educators and researchers working on college campuses, to inform all students about the pros and cons of using this method for contraception. Since withdrawal us is so high (as many as one-third of college students use the method), educators and researchers need to ensure understanding of the lack of protection from STIs and unplanned pregnancy.

When utilizing the NCHA II to assess this behavior, it worked as it should and demonstrated good internal consistency. Internal consistency is based on the assumption that items measuring the same construct should be correlated (Kimberlin & Winterstein, 2004) and based on the results of the Cronbach's alpha scores. This was the case. Further, the instrument was rather easy to use when conducting the logistic regression. Logistic regression, however, is a data analysis test that is used with dichotomous variables (Kleinbaum & Klein, 2010). It should be expected, then, that the dichotomous nature of the results of the NCHA II should perform well using this type of analysis.

## Limitations

Despite the completion of the current study, there are limitations that should be noted. First, some of the behaviors were not well defined. For example, the definition of "drink" is left up to interpretation by the participant. Further, there is a question regarding being in an intimate relationship that involved sexual abuse (i.e. forced to have sex when not wanted or perform unwanted sexual acts on another) and another question that asked about attempted or actual sexual touching or penetration. Students who have experienced the first may have responded positively to the second question as well, being confused that the questions are asking about two different types of relationships/settings. Second, students were allowed to indicate more than one method of contraception. Future studies should investigate students who only use withdrawal as a contraceptive method. The original NCHA implemented between 2000 and 2008, however, did not allow participants to indicate more than one method and the use of withdrawal was still listed as the third most common method (ACHA, 2008a). Third, the instrument was a self-report questionnaire. With sensitive issues such as sexual activity, students may respond in ways that they think are socially acceptable and therefore, not provide the most accurate response. These results highlight the issue with self-reported data. When self-reports are used, common method variance can introduce a serious problem and may cause researchers to find significant outcomes in their analyses when in fact, there are none, and the results are actually due to the method employed (Whitman & Woszczynski, 2004). More research should be conducted on the validity of self-report, health behaviors in college students with regard to sensitive data

such as alcohol use, drug use, and sexual activity. There has been research conducted in this area with regard to adolescents and college students in the learning environment but not much has been conducted with college students self-report of health behaviors (Herzog & Bowman, 2011). Fourth, the data were limited by only allowing categorical responses and not allowing any information regarding categories of relationships (i.e. one-night stand, long-term, mutually monogamous relationship, etc.) in which sexual activity occurred. Fifth, institutions self-select and therefore, the results were not representative of all college students. The ACHA should offer an incentive program so institutions would participate, thus obtaining a better representation of U.S. college students. Sixth, due to the sheer size of the NCHA II, it is difficult to adequately explore all the variables related to the use of withdrawal for contraception.

### Suggestions for ACHA Regarding the NCHA II

Since one of the research questions guiding the current study was related to the use of the NCHA II as an adequate tool to gather information on withdrawal as a contraceptive choice in college students, there are several suggestions for the ACHA regarding use of the NCHA II. The current study investigated the inter-item reliability of the NCHA II by combining like items from the instrument into six variables. Cronbach's alphas for the alcohol use, tobacco/drug use, and sexual violence had good to excellent results at .787, .746, and .736, respectively, indicating the items combined to represent these variables "hang well" together and demonstrated high internal consistency. The alpha score for the sexual behaviors variable was .633, indicating acceptable consistency. The alpha scores for the sexual history and the relationship

abuse variables, however, fell below the acceptable score and resulted in scores of .483 and .523, respectively. The items used to create these variables may need to be reexamined to ensure high internal consistency. Another suggestion is to change the time frame of the questions asked to more accurately reflect on the overall picture of the health of college students. It is not reasonable to expect college students to recall behaviors from a year ago. Perhaps allowing students to recall behaviors, other than chosen method of contraception, from last sexual intercourse regarding their sexual activity rather than the last 12 months would make the responses more valid and reliable. Second, decrease the size of the instrument to allow for better data analyses since having so many variables to analyze may be cumbersome. It would be helpful for researchers and practitioners alike if the NCHA II was divided into several smaller instruments (see Chapter 3 factor analysis results for six potential scales) with better focus on few health behaviors.

## Implications for Health Education

Implications for health educators and researchers working on college campuses are numerous. Professionals should study the use of withdrawal as a contraceptive method exclusively and educate students on this method. As this method is the third most common method used by students, more research should be conducted on the connection of withdrawal to other variables such as stress levels and other mental health issues such as depression, anxiety, and suicidal ideations. One group of researchers investigated the connection between mental health and contraceptive choices by assessing depression and stress levels (Hall, Kusunoki, Gatny, & Barber, 2014). The

researchers found women with co-occurring stress and depressive symptoms had over twice the risk of pregnancy than those women without symptoms while other researchers, albeit in clinic-based samples, identified associations between women's mental health status and risky contraceptive behaviors including lack of contraceptive use, using the methods incorrectly, discontinuing use, and using less effective methods (Bennet, Culhane, McColuum, & Elo, 2006; Farr, Bitsko, Hayes, & Dietz, 2010; Garbers, Correa, Tobier, Blust, & Chiasson, 2010; Hall, Moreau, Trussell, & Barber, 2013a; Hall, Moreau, Trussell, & Barber, 2013b; Hall, Reame, O'Connell, Rickert, & Weshoff, 2012; Ko, Farr, Dietz, & Robbins, 2012; Lee, Casanueva, & Martin, 2005; Zink, Shireman, Ho, & Buchanan, 2002). None of these researchers, however, examined male choices of contraception and mental health symptoms. Perhaps mental health and contraceptive choices in men is an area for further study.

While research on college students has increased over the years, it is imperative that researchers continue to focus on the sexual behaviors of students as consequences of unsafe sexual activity can affect student's present and future sexual health. Future researchers could examine the type and extent of sexual health education received at the public school level and how this education translates to behaviors regarding sex and college students. Most studies on college students' sexual behaviors have been conducted to discover negative outcomes of sexual activity (i.e. pregnancy and sexually transmitted infections). Research, however, should perhaps shift and focus on the students who are making responsible decisions regarding their sexual health. Much research has been conducted with regard to the negative outcomes of sexual activity in

college students, but do researchers and educators ask questions to those students who are engaging in positive, healthy sexual relationships? Perhaps this would be an area of study that would need more research.

As the ACHA continues to refine the NCHA II, emphasis should also be placed on partner characteristics such as race and ethnicity as well as asking more specific questions regarding the type of relationships (i.e. one-night stand, long-term, mutually monogamous, etc.) in which students are engaging in sexual activity. These questions could further narrow the audience on which researchers and practitioners focus with regard to educating about withdrawal as well as other sexual health behaviors.

Safe sexual behavior is important to the health of college students. It is one of the Healthy Campus Objectives set forth by the American College Health Association and implemented on college campuses across the nation (ACHA, 2012). The researcher felt this study demonstrated the need to educate on the connection between certain health behaviors and choice of contraception as well as suggestions for improvement on the ACHA NCHA II.

# CHAPTER V

## SUMMARY AND CONCLUSIONS

The overall purpose of this dissertation was to examine the ACHA NCHA I and II survey instruments. The NCHA II is currently being used by practitioners and researchers on college campuses across the U.S. and Canada. This research was conducted using multiple methods and written into three manuscripts that addressed use of the instrument, the validity and reliability of the data produced by the instrument, and issues related to the practical usage of the tool to investigate a health behavior in college students. After investigating these three areas, it was discovered that numerous researchers use the NCHA II and the data collected via the instrument in inappropriate ways. Further, it was discovered that the quality of the data produced by NCHA II is adequate but could be better.

The review and analysis of the literature of published studies, in which the NCHA I and II were used to collect data on the health behaviors, habits, and perceptions of college students, resulted in several common limitations. One such limitation was the overrepresentation of Caucasian females. By having an overrepresentation of one population, researchers cannot expect to represent the entire population of college students. Second, insensitive items from the questionnaire were found. These items could be leading those using the NCHA I or II to draw erroneous conclusions regarding college student health behavior. The NCHA I and II are tailored to undergraduates, yet it is used by some researchers to study graduate and non-traditional student behaviors. Behaviors are not well-defined. Students, therefore, interpret the questions without the

usual parameters of well-defined terms. Such individual interpretation affects the validity of the responses.

The scales of the items measured were mostly nominal or ordinal. By only having nominal or ordinal responses, researchers should only use data analyses appropriate to those levels of scale and should not be conducting analyses for interval or ratio level data. Design of the instrument was also a limitation listed by researchers using the assessment tool. For researchers wanting to delve into a specific health behavior, they may find that the NCHA I and II only have one or two questions to represent that behavior. Having more questions on specific and individual behaviors would aid researchers. Many researchers indicated the NCHA I and II lack questions that would have been useful for their studies. These missing items would have aided researchers allowing them to answer their true research questions. Many of the items had different and quite long recall timeframes. Participants then had to provide their best guess as to what their behaviors were in the distant past. Finally, the practice of allowing self-selection of participating institutions resulted in a non-generalizable/non-representative population of students and led to inappropriate data analyses.

The second manuscript was a three-part analysis of the instrument itself and included validity and reliability testing. In the first phase, content validity was assessed by conducting an expert panel review. Factor analysis using principal axis factoring, Kaiser-Meyer Olkin Measure of Sampling Adequacy, Bartlett's test of sphericity, and a promax oblique rotation were conducted in the second phase to address construct validity. Internal consistency was assessed by conducting Cronbach's alpha testing on

17 variables created by combining like items from the instrument in the third phase. The researcher investigated factors beyond the actual instrument items, factors affecting data quality, and instrument-related factors. Results of the analyses indicated the instrument would be better with a theory base in order for researchers to be able to answer their theoretical research questions. Although the NCHA II is adequate for frequency type investigations, researchers wishing to answer more in-depth questions would be better off using a more theoretically sound tool. Further, the analyses indicated much work had to be conducted when combining items to form variables in order for the reliability tests to result in acceptable Cronbach's alpha scores.

In the third manuscript, the researcher investigated the NCHA II while also examining a health behavior, withdrawal as a contraceptive method in college students. The purpose of the study was twofold: to examine the ACHA NCHA II while identifying factors associated with withdrawal as a contraceptive method in college students. There were two research questions leading the study: (1) What behavioral and demographic characteristics are associated with withdrawal as a contraceptive method in college students and (2) Is the NCHA II an adequate tool to address this and other health behaviors in this population? The results of the study indicate withdrawal is used by students who were young, heterosexual, Black/non-Hispanic, live on campus in campus residence halls, been in emotionally abusive relationships, consume alcohol, have multiple sex partners, engage in anal sex, and use condoms for oral and anal sex. For a study such as this one, the NCHA II was an acceptable instrument to use as the data

analyses used did not require transformation of data; however, some of the inter-item reliability scores were below the acceptable level.

## Discussion

The NCHA II is a nationally recognized health assessment tool initially developed in 1999 by an interdisciplinary team of college health professionals. It was created for use by health professionals and researchers working at institutions of higher education and covers seven content areas for health behaviors found in college students: 1) health, health education, and safety; 2) alcohol, tobacco, and drugs; 3) sex behavior, perceptions and contraception; 4) weight, nutrition and exercise; 5) mental and physical health; 6) impediments to academic performance; and 7) demographics. These seven areas of content comprise over 300 questions (American College Health Association [ACHA], 2004). Data resulting from administration of this instrument are related to students' health habits, behaviors, and perceptions (ACHA, 2013a). The results of the studies from this dissertation indicate the instrument is useful for only certain types of research questions. It is a useful instrument for collecting frequency data on college campuses; however, investigators and researchers wishing to conduct studies with the NCHA II basing their research on theory and using higher level of scale data analyses should proceed with caution.

## Limitations

All research studies are conducted with limitations. First, through the empirical search and review of literature, there were some articles that may have been missed. Further, the results from this review were mostly conducted on the NCHA I instrument.

Another review should be conducted solely investigating and reviewing studies that look at the NCHA II instrument. Second, there was a large amount of missing data which had to be dealt with accordingly. Future studies should be more sensitive to the missing data. Third, items combined from the instrument for the second manuscript were done at the primary investigator's discretion. This may have introduced unknown and unintended bias to the study.

## Strengths

The results of this study advance the field of health education by investigating an assessment tool used by many health educators and researchers working with college students and on college campuses. Further, psychometric properties of a popular assessment tool used on college campuses across the U.S. and Canada were investigated in this study. Research tools should be investigated in this manner prior to and even after implementation to ensure the instrument is both valid and reliable. Validation is an unending process as one measures not just the instrument itself, but rather the use to which the instrument is put (Nunnally, 1978). It is important to always further this type of analysis of measurement tools in order to ensure researchers are using the best tools and obtaining quality data. This study has provided evidence that assuring quality measurement tools is essential in the field of health education to obtain valid and reliable data and to ensure investigators are using appropriate data analyses to make their conclusions. It also shows the importance of theory when developing an instrument. It is difficult for researchers to conduct theoretically sound research when the tool they are using to collect data is not based on a theory when being developed. For frequency type

results, a theory may not be a necessity, but for theoretically-based research questions, theoretically based instruments are essential. Crocker and Algina (1986) note that "constructs cannot be defined only in terms of operational definitions but must also have demonstrated relationships to other constructs or observable phenomena" (p. 7). Having a solid theoretical background for the measurement scale should always be considered before developing a scale, and in essence, at least a tentative theoretical model should serve as a guide to the development (DeVellis, 2012).

This study also adds to the field in investigating a common health behavior in college students, withdrawal a method of contraception. Being the third most common contraceptive method (ACHA, 2013b), withdrawal should not be considered "rare" and should be listed as a common method chosen by college students. Health educators and practitioners should educate college students on the use, risks, and benefits of using withdrawal as a method of contraception. According to this study, females are more likely to use this method of contraception over males. Many females learn about withdrawal from peers, parents, and the media who are often misinformed regarding the basic use and efficacy of withdrawal as a contraceptive method, and they communicate that misinformation to young women (Dude et al., 2013). It is, therefore, imperative that health educators and researchers working on college campuses inform all students about the pros and cons of using this method for contraception. With withdrawal being so high (as many as one-third of college students use the method), educators and researchers need to ensure the understanding regarding the lack of protection from infections and unplanned pregnancy.

## Implications for Health Education Practice and Research

There are several implications for the field of health education from the conclusions of this dissertation but the focus will be on three. The importance of proper instrument development cannot be overlooked when investigating health behaviors. Beginning with a theory-based approach and developing the instrument from those constructs should not be ignored. Second, continuing to investigate and improve upon the instruments that are available can also not be overlooked. Validation of instruments is an ongoing field of study. Third, the sexual behavior of college students continues to be a concern for those working on college campuses. With infection and pregnancy rates continuing to rise in college students, the sexual activity of college students should be a continuous field of study.

## Future Directions

As a result of this research, two recommendations are submitted to the American College Health Association. First, it is recommended that ACHA reexamine the NCHA II and make changes based on the results of not only this study but other studies that have conducted psychometric analyses of the instrument. Second, it is recommended that in addition to the NCHA II, ACHA create multiple instruments with the goal of reliably capturing data that accurately measure the health behaviors in question. For example, an instrument dedicated to college student drug use would be separate from an instrument dedicated to measuring college student sexual behavior. After conducting the factor analysis in the second manuscript, a plan was laid out for developing such instruments.

This type of analysis should be conducted again by others to assure a consensus is reached regarding the type of instruments to create.

Continuing this research and perhaps development of an instrument based on the results from this study is a goal. This instrument would begin with a theory (for example, the Theory of Planned Behavior) as a base and may result in researchers learning more about college student health behaviors than they were able to discover using the NCHA II. To solve the representation issue, the ACHA could randomly select institutions to participate rather than allowing for self-selection of institutions. This would produce a much more valid and reliable dataset that would be representative of all college students. Further, with regard to the sexual behaviors of students, research conducted focusing on the positive outcomes resulting from health sexual relationships would be a route to take. Health educators are always focusing on the negative outcomes of irresponsible college student decisions, but what about the student who is engaging in healthy responsible decisions regarding their sexual health? An instrument needs to be created in order to do this type of study.

The field of test and measurement and conducting more research on this topic as well as developing skills to create and investigate instruments used in this line of work is also a goal. Further, self-reported health behaviors may call into question the validity and reliability of the results. Investigating the self-reported health behaviors of college students to determine if this is truly the best way to collect data on these types of behaviors would be another goal. The challenge is welcomed.

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